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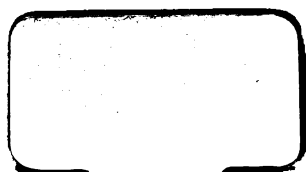
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PROCEEDINGS
OF THE
ASSOCIATION OF MUNICIPAL AND SANITARY
ENGINEERS AND SURVEYORS.

VOLUME VIII.—1881-82.

EDITED BY
THOMAS COLE,
ASSOC. M.I.C.E.,
(Secretary of the Association).

*This Association is not as a body responsible for the facts and opinions
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TRAPP, S. C.	88, Mosley Street, Manchester.
TUDOR, E. C. B.	Surveyor to the Local Board, Goole, Yorkshire.
VAWSE, R., M. Inst. C.E. . .	17, Cooper Street, Manchester; <i>Hon. Secretary</i> , Lancashire and Cheshire District.
(<i>Vice-President.</i>)	
VEEVERS, H., Assoc. M.I.C.E.	Surveyor to the Local Board, Dukinfield.
WALKER, T., Assoc. M. Inst. C.E.	Surveyor to the Local Board, Croydon, Surrey.
WARE, C. E., M. Inst. C.E. . .	Gandy Street Chambers, Exeter.
WEBSTER, J. L.	Borough Surveyor, Malton.
WELBURN, W.	Surveyor to the Middleton and Tonge Improvement Commissioners.
WHEELER, W. H., M. Inst. C.E.	Borough Surveyor, Boston, Lincolnshire.
WHITE, W. H., M. Inst. C.E. (<i>Vice-President.</i>)	Engineer to the Local Board, Oxford.
WHITLOW, HENRY	Surveyor to the Local Board, Sowerby Bridge.
WILSON, J. P.	87, Lord Street, Liverpool.
WILSON, J.	Surveyor to the Local Board, Bacup, Lancashire.
WILSON, WILLIAM	Surveyor to the District Local Board, Dalton-in-Furness.
WINSHIP, G., Assoc. M.I.C.E.	Borough Surveyor, Abingdon, Berks.
WITTS, J. W.	Surveyor to the Market Harboro' Rural Sanitary Authority.
WOOD, A. R.	Surveyor to the Local Board, Tunstall.
WORSWICK, R. A.	Surveyor to the Local Board, Whitley, Newcastle-on-Tyne.
WRIGHT, J.	Borough Surveyor, Macclesfield, Cheshire.

TOWNS AND DISTRICTS REPRESENTED BY MEMBERS OF THE ASSOCIATION.

ABINGDON	G. Winship.
ACORINGTON	E. Knowles.
ASHTON-UNDER-LYNE	J. T. Earnshaw.
ASTON MANOR	J. W. Brown.
"	W. Batten.
AUDENSHAW	J. H. Burton.
BACUP	J. Wilson.
BARNLEY	J. H. Taylor.
BARROW-IN-FURNESS	W. H. Fox.
BARTON-UPON-IRWELL	John Price.
BARTON, EOOLES, WINTON, AND MONTON	T. Heywood.
BATLEY	D. Hildred.
BENWELL	T. Dawson.
BEVERLEY	J. Beaumont.
BINGLEY	R. Armistead.
BIRKENHEAD	T. C. Thorburn.
BIRMINGHAM	W. S. Till.
"	E. Pritchard.
BLACKBURN	W. B. Bryan.
BLACKPOOL	T. Sunderland.
BLAYDON-ON-TYNE	M. Hawdon.
BOLTON	J. Proctor.
BOSTON	W. H. Wheeler.
BOURNEMOUTH	G. R. Andrews.
BOWDEN	J. Newton.
BRADFORD	J. H. Cox.
BRECKNOCK	B. Davies.
BRIDGEWATER	G. B. Laffan.
BRIDLINGTON	S. Dyer.
BRIGHTON	P. C. Lockwood.
BRISTOL	F. Ashmead.
BRITON FERRY	H. F. Clarke.
BROMLEY	H. S. Cregeen.
BURNHAM, SOMERSET	B. Salisbury.
BURTON-UPON-TRENT	E. Clavey.
BURY	J. Cartwright.
"	J. Farrar.
CANTERBURY	J. G. Hall.
CARLISLE	H. U. McKie.
CHELTENHAM	G. W. Sadler.
CHESTER	I. M. Jones.
CHESTERFIELD	W. F. Howard.
CHISWICK	H. O. Smith.
CLEVEDON, SOMERSET	H. Taylor.
CONGLETON	W. Blackshaw.
COVENTRY	E. J. Purnell.
CRUYDON	T. Walker.

xiv TOWNS AND DISTRICTS REPRESENTED BY MEMBERS.

DALTON-IN-FURNESS	William Wilson.
DANESFORD	G. Jennings.
DERBY	Thos. Coulthurst.
"	G. Thompson.
DEWSEBURY	R. J. Duff.
"	B. C. Cross.
DORCHESTER	W. Thomas.
DOVER	M. Curry.
DUKINFIELD	H. Veevers.
EALING	C. Jones.
EASTBOURNE	C. Tones.
EPSOM	J. R. Harding.
EXETER	H. P. Boulnois.
"	C. E. Ware.
GATESHEAD-ON-TYNE	J. Bower.
GLOUCESTER	R. Read.
GOOLE, YORKSHIRE	E. C. B. Tudor.
GRANTHAM, LINCOLNSHIRE	S. G. Gamble.
GREAT GRIMSBY	J. Maughan.
HALIFAX	E. R. S. Escott.
HANLEY	J. Lobley.
HARBORNE	W. Newey.
HARROGATE, W. R. YORKSHIRE	E. W. Harry.
HARROW	F. N. Cowell.
HARWICH	H. Ditcham.
HASLINGDEN	T. Bretherton.
HECKMONDWIKE	T. Gledhill.
HEREFORD	J. Parker.
HEXHAM	R. Grieves.
HEYWOOD	J. Diggle.
HINCKLEY	F. T. Maltby.
HINDLEY	J. P. Wilson.
HORNSEY	J. R. Rogers.
HOVE	E. B. Ellice-Clark.
HULL	J. Fox Sharp.
HURST BROOK	J. Heys.
HYDE	J. Mitchell.
ILFRACOMBE	Philip Pile.
IPSWICH	E. Buckham.
KIDDERMINSTER	A. Comber.
KIRKLEATHAM	J. Howcroft.
LANCASTER	A. Creer.
LEAMINGTON	E. M. Richards.
LEEDS	T. Hewson.
LEEK	T. Frost.
LEICESTER	J. Gordon.
LEIGH, LANCASHIRE	G. Dickenson.
LEWES	A. Holt.
LEYTON, E.	W. Dawson.
LITTLEBOBOUGH	F. H. Shuttleworth.
LIVERPOOL	C. Dunscombe.
"	G. F. Deacon.
"	J. H. Smethurst.
"	J. P. Wilson.
LLANDUDNO	T. T. Marks.
LOFTUS, SALTBURN-BY-THE-SEA	T. W. Stainthorpe.

TOWNS AND DISTRICTS REPRESENTED BY MEMBERS.

XV

LONGTON	A. Hardwicke.
LOWESTOFT	R. H. Inch.
LUTON, BEDFORDSHIRE	W. H. Leete.
MACCLESFIELD	J. Wright.
"	H. S. Aspinwall.
MAIDSTONE	J. S. Anscomb.
MALTON	J. L. Webster.
MANCHESTER	J. Allison.
"	J. G. Lynde.
"	S. C. Trapp.
"	R. Vawser.
MARKET HARBOUR	E. G. Mawby.
"	J. W. Witts.
MERTHYR TYDFIL	S. Harpur.
MIDDLESBROUGH	E. D. Latham.
MIDDLETON	W. Welburn.
MILVERTON	G. F. Smith.
MORPETH	T. W. Middlemiss.
NELSON-IN-MARSDEN	W. Dent.
NEWBURY	B. Sargent.
NEWCASTLE-ON-TYNE	W. G. Laws.
"	A. M. Fowler.
"	J. P. Spencer.
NEWCASTLE-UNDER-LYME	J. Pattison, Jun.
NEWTON-IN-MAKERFIELD	R. Brierley.
NORDEN	W. E. Heap.
NORTHAMPTON	J. H. Pidcock.
NORTH BIERLEY	J. Cook.
OLDBURY	J. Devis.
OLDHAM	A. Foote.
OSWESTRY	E. B. Smith.
OVER DARWEN	W. Stubbs.
OXFORD	W. H. White.
PLYMOUTH	R. Hodge.
PRESCOT	W. Goldsworth.
PRESTWICH	S. C. Trapp.
READING	A. W. Parry.
REDDITCH	T. W. Baylis.
REIGATE	J. H. C. B. Hornibrook.
RHYL	Robt. Hughes.
RICHMOND	F. S. Brunton.
ROCHDALE	S. S. Platt.
ROCHESTER	W. Banks.
ROTTERHAM	G. Jennings.
RYDE	F. Newman.
SALE	A. G. McBeath.
SELBY, YORKSHIRE	J. Holmes.
SHEERNESS	H. W. Stringfellow.
SHEFFIELD	R. Davidson.
SHEREWSBURY	G. J. Butler.
SKELTON	John Downie.
SKIPTON	A. Ramsden.
SOLIHULL, WARWICKSHIRE	A. T. Davis.
SOUTHAMPTON	J. Lemon.
SOUTHPORT	W. Crabtree.
SOUTH SHIELDS	M. Hall.
SOUTH STOCKTON	S. E. Thorold.

SOWERBY BRIDGE	H. Whitlow.
STALYBRIDGE	Amos Lee.
STAPLETON	J. P. Curtis.
STOCKTON-ON-TEES	J. Hall.
STOKE-ON-TRENT	W. Bowen.
STRATFORD-ON-AVON	T. T. Allen.
STRETFORD	H. Royle.
STROUD	J. P. Lofthouse.
ST. GEORGE, GLOUCESTERSHIRE	W. Dawson.
ST. HELENS, LANCASHIRE	J. Hart.
ST. THOMAS, NEAR EXETER	S. Churchward.
SUNDERLAND	B. S. Rounthwaite.
SWANSEA	E. Cousins.
SWINDON, WILTS	T. V. H. Davison.
SWINTON, NEAR ROTHERHAM	J. C. Haller.
TEDDINGTON	T. Goodchild.
TEWESBURY, GLOUCESTERSHIRE	W. H. Gray.
TIPTON, STAFFORDSHIRE	W. M. Jepsen.
TIVERTON, DEVON	Wm. Rowe.
TONBRIDGE	W. Noot.
TOXTETH PARK, LIVERPOOL	J. A. Hall.
TRANMERE	W. A. Richardson.
TUNSTALL	A. R. Wood.
TYNEMOUTH	C. T. Gomoszynski.
VENTNOR	R. S. Scott.
"	J. G. Livesay.
WAKEFIELD	R. Porter.
WALLASEY	J. T. Lea.
WALSALL	W. J. Boys.
WALTHAMSTOW	G. B. Jerram.
WANSTEAD	J. T. Bressey.
WARMINSTER	T. Oruse.
WARRINGTON	T. Longdin.
WARWICK	T. Broughton.
WATERLOO, LIVERPOOL	R. Thompson.
WATFORD	O. O. Lovejoy.
WEDNESBURY	J. W. Fereday.
WELLINGBOROUGH	E. Sharman.
WEST BROMWICH, STAFFORDSHIRE	J. T. Eayrs.
WEST DERBY, LIVERPOOL	E. H. Allies.
WEST HAM, LONDON	L. Angell.
WEYMOUTH AND MELCOMBE REGIS	W. B. Morgan.
WHITEHAVEN	R. Pickering.
WHITLEY	R. A. Worswick.
WHITWORTH	Thos. Holt.
WILLESDEN	O. C. Robson.
WILLINGTON QUAY, NORTHUMBERLAND	P. W. Thomson.
WITHINGTON	J. Swarbrick.
WOLVERHAMPTON	G. E. Thoms.
WOODFORD	J. D. Hooper.
WORKSOP	J. Allsopp.
WREXHAM	J. W. M. Smith.
YORK	W. G. Penty.

RULES OF THE ASSOCIATION.

I.—That the Society be named the “ASSOCIATION OF MUNICIPAL AND SANITARY ENGINEERS AND SURVEYORS.”

II.—That the objects of the Association be—

- a. The promotion and interchange among its Members of that species of knowledge and practice which falls within the department of an Engineer or Surveyor engaged in the discharge of the duties imposed by the Public Health, Local Government, and other Sanitary Acts.
- b. The promotion of the professional interests of the Members.
- c. The general promotion of the objects of Sanitary Science.

III.—That the Association consist of Civil Engineers and Surveyors holding chief permanent appointments under the various Municipal Corporations or Sanitary Authorities within the control of the Local Government Board, and such Honorary Members as shall be elected by the Council. Members who cease to hold such appointments after the Annual Meeting of the Association in 1881 are eligible for re-election by the Council, but will be disqualified from holding any office.

IV.—That the Affairs of the Association be governed by a Council, consisting of a President, Three Vice-Presidents, Twelve Members, and an Honorary Secretary, to be elected annually. The Past Presidents and the District Secretaries for the time being shall also be Members of the Council.

V.—That the Council shall nominate one name for President, six for Vice-Presidents, one for Hon. Secretary, and twenty-two Ordinary Members from which to elect the Council. Such Nominations shall be printed and sent to each Member of the Association not less than fourteen days previous to the Annual Meeting. Every Member shall be entitled to vote for or erase any of such Nominations, or substitute other names, subject in all cases to the limits of Rule IV., and return the same within seven days from the date of issue. Such ballot papers shall be examined in London by the President, Secretaries and two Scrutineers appointed at the previous Annual Meeting, or by any two of the aforesaid Members.

- VI.—That the Association be formed into District Committees which shall include the whole of the Members. Such Committees shall meet from time to time, in convenient centres, for the discussion of matters of local and general interest connected with the Association. Each District Committee shall appoint a Local Secretary, who will keep records of local proceedings, and communicate with the Council. No District Committee or Local Secretary shall be entitled either to represent or act on behalf of the Association.
- VII.—That a General Meeting and Conference of the Association shall be held annually in such towns, in rotation, as may afford convenient centres for assembling the Members.
- VIII.—That an entrance-fee of One Guinea, and a subscription of One Guinea per annum, from Civil Engineers and Surveyors under Rule III., shall constitute Membership of the Association.

ASSOCIATION OF MUNICIPAL AND SANITARY ENGINEERS AND SURVEYORS.



NINTH ANNUAL MEETING.

LONDON, *June 29, 30, and July 1, 1882.*

GENERAL BUSINESS.

THE Members having assembled in the Lecture Theatre of the Institution of Civil Engineers, Mr. W. S. Till, President, took the chair, and the Minutes of the Annual Meeting held in Birmingham in July 1881, were read, confirmed, and signed.

The SECRETARY then read the Annual Report for the year ending April 30th, 1882.

ANNUAL REPORT.

The Council have great satisfaction in again presenting their Annual Report. The Members are specially to be congratulated upon the steadily increasing success and substantial progress of the Association during the past year.

Subsequent to the last General Meeting, which was held at Birmingham in the beginning of July 1881, five District Meetings have been held: at Eastbourne, on the 22nd August; at Stockton-on-Tees, on the 24th September; at York, on the 24th February; at Sunderland, on the 22nd April; and at Goole, on the 17th June. The value of the District Meetings continues to be warmly appreciated by the Members, as is evinced by the numbers attending, and by the well-sustained discussions on the papers read, which were in each case good. The visits to works, forming an agreeable feature in their programmes, were highly instructive and interesting.

The Council have to announce that eighteen new Members have joined the Association during the financial year, while five have resigned, and three from whose addresses letters have been returned, have been written off the list of Members; and report with much regret the death of three Members, Mr. A. W. Morant, of Leeds, Mr. Cole, of Hereford, and Mr. Alty, of Plymouth. Mr. Morant's death having occurred so soon after the last Annual Meeting, the Council took the opportunity of placing on record, in the last volume of the 'Proceedings,' their appreciation of the services of their much respected Past President, and the Council consider this a proper occasion of again testifying their sense of the great loss the Association has suffered in his death. The numbers of Members on the close of the year was 5 Honorary Members, 206 Ordinary Members, or in all 211. These figures show the steady progress of the Association, but as its efficiency and usefulness will be increased by further additions to its numbers the Council request once again that the Members will exert themselves to induce their brother officers who have not already joined, to become Members.

The Council call attention to the alteration in Rules III. and V., which were fully discussed and resolved upon at the last General Meeting. These rules as amended appeared in the last volume of the 'Proceedings.'

A list of suggestions was put forward at the last Annual Meeting by Mr. J. A. Hall, and was referred to the Council for consideration. After fully discussing the matter, it was unanimously resolved, in view of the difficulties of obtaining the necessary information, that the Council decline to advise the adoption of these suggestions.

The ballot lists were issued in accordance with the Rules of the Association, and the Scrutineers appointed at the last Annual Meeting have reported the following gentlemen as elected to the Council.

President.—Chas. Jones.

Vice-Presidents.—J. Lobley, R. Vawser, and W. H. White.

Ordinary Members of Council.—J. Allison, H. P. Boulnois, W. B. Bryan, E. Buckham, R. Davidson, C. Dunscombe, Jos. Gordon, T. Hewson, H. U. McKie, A. W. Parry, J. Proctor, and T. C. Thorburn.

General Honorary Secretary.—Chas. Jones.

Treasurer.—Lewis Angell.

It will be observed that the accompanying duly audited balance sheet of the financial year, bears out what has been said with regard to the satisfactory state of the Association, inasmuch as the balance in hand on the 30th April, 1882, after paying off all claims to that date was 106*l.* 10*s.* 3*d.* The amount in hand on the same date in 1881 was 82*l.* 5*s.* 7*d.* The statement of assets and liabilities also shows that the Association continues to be in a thoroughly sound financial position.

Mr. JERRAM moved the adoption of the Report, which was seconded by Mr. McKie.

Mr. ESCOTT raised the question of the advisability of the offices of President and Honorary Secretary being filled by the same individual. The point having been fully discussed, Mr. Angell stated that Mr. Jones was not only elected President by the Members, but he was also unanimously elected Honorary Secretary. The subject then dropped.

Mr. VAWSER called attention to the item in the expenditure account, "Expenses to solicitor in collecting arrears, 1*l.* 15*s.*" He submitted that this was essentially a Members' question, and should not be dealt with exclusively by the Council. He was sure that the Members of the Society, the great majority of them, wished to deal with this matter in a manner which would not necessitate any such item appearing in the accounts again, and he referred to the resolution of the Council, passed that day, that the volume of 'Proceedings' should not be sent to Members whose subscriptions were in arrear. He was confident that the Council would receive the moral support of the Members in this matter.

The PRESIDENT pointed to the necessity for punctuality in payment of the subscriptions. It would save the Secretary much trouble if the necessary arrangements were made to prevent remarks of this kind in future.

The motion was then put and agreed to, and it was resolved that the ballot lists be destroyed.

Mr. A. W. Parry and Mr. W. H. White were unanimously appointed Auditors for the ensuing year.

Mr. Lewis Angell and Mr. A. W. Parry were unanimously appointed Scrutineers for the ensuing year.

Mr. ESCOTT criticised the appointment of a Member of Council as scrutineer as being unusual, but it was explained that Mr. Parry's services, owing to his living near London, were more at

the command of the Council than, perhaps, those of any other Member living at a distance.

The PRESIDENT ruled that the appointment had been confirmed, and discussion on the subject was now out of order.

The question of the "locale" of the next Annual Meeting was thoroughly discussed, and it was ultimately decided that it should be held at Oxford.

Mr. TILL said it was now his pleasing duty to introduce to the Members the President-elect, Mr. C. Jones. Mr. Jones had worked for the Association for a number of years, and as he had worked in the past he believed he would work in the future.

Mr. Till then vacated the chair.

Mr. C. JONES, of Ealing, having taken the Presidential chair, said that a courteous recognition was due to the Members present for the trouble they had taken to attend from all parts of England, and he pointed out as an example, which all would do well to follow, the presence of Mr. McKie, who had travelled from Carlisle, as showing earnestness in pursuit of his profession and zeal in the cause of this Association.

Mr. JONES paid a high tribute of regard and esteem to Mr. Till who had just vacated the chair. He was sure that this esteem was universally felt by the Members.

A vote of thanks to the retiring President was proposed by Mr. Angell, seconded by Mr. Vawser, and carried unanimously.

The President then read his inaugural address.*

CHAS. JONES, *Hon. Sec.*

THOMAS COLE, *Secretary.*

* This address and the papers read at the meeting will be found at the end of the volume.

BALANCE SHEET.

5

Dr. STATEMENT OF RECEIPTS AND EXPENDITURE FOR YEAR ENDING APRIL 30TH, 1882. Cr.									
RECEIPTS.					EXPENDITURE.				
	£	s.	d.			£	s.	d.	
To Balance at Bank (May 1st, 1881)	82 5 7		By Hanley Meeting	..	..	1 15 0	
" Entrance Fees	18 18 0		" Messrs. Cook and Hammond (Printing, &c.)	..	..	12 6 6	
" Subscriptions	183 15 0		" "	..	..	3 15 6	
" Arrears	2 2 0		" Stockton Meeting	..	..	3 13 0	
" Publisher's Sale of Proceedings	8 14 4		" Annual	..	..	15 13 8	
" Balance of Petty Cash	1 3 11		" Barnsley	..	..	1 5 0	
" Subscription paid in advance	1 1 0		" York	..	..	2 2 0	
					" Messrs. Clowes (Printing vol. vii.)	..	..	74 15 0	
					" Expenses to Solicitor in collecting arrears	..	..	1 15 0	
					" Secretary's Salary	..	..	60 0 0	
					" Petty Cash—Stationery, &c.	..	..	1 17 1	
					" Postage, General	..	..	2 19 1	
					" do. Circulars	..	..	6 1 9	
					" do. vol. vii.	..	..	3 11 0	
					" Balance at Bank	..	..	106 10 3	
								£297 19 10	
Balance, May 1st, 1882	£106 10 3						
STATEMENT OF ASSETS AND LIABILITIES, APRIL 30TH, 1882.									
LIABILITIES.					ASSETS.				
	£	s.	d.			£	s.	d.	
To Estimated Liability on vol. viii.	30 0 0		By Balance at Bank	..	..	106 10 3	
" Sundry Printing	7 0 0		" Subscriptions in Arrear	..	..	£34 13 0	
" Secretary, balance of Petty Cash	1 3 11		" " less 50 per cent. bad	..	..	17 6 6	
" Outstanding Accounts	0 0 0		" Proceedings in Stock	..	..	£61 15 6	
" Balance	116 10 7		" " less 50 per cent.	..	..	30 17 9	
								£154 14 6	
					Balance, May 1st, 1882	..	..	£116 10 7	
Examined and found correct, Wm. Hy. White,					CHAS. JONES, Hon. Secretary.				
ALBERT W. PARRY, } Auditors.					THOMAS COLE, Secretary.				

DISTRICT MEETING AT EASTBOURNE,

August 22, 1881.



The Members assembled at the Surveyor's office, and after having attended the Exhibition of Sanitary Appliances and Building Construction, held at the Devonshire Park, proceeded to the Sea-wall Works, where a discussion was held, after which they proceeded to the Ejector Works, at Sea-side, where, after reviewing the works, the following paper was read and discussed :—

SHONE'S EJECTOR SYSTEM AS CARRIED OUT AT EASTBOURNE.

By CHARLES TOMES, SURVEYOR TO THE LOCAL BOARD,
EASTBOURNE.

Before describing the action of the ejector system as applied at Eastbourne, the author proposes to briefly state the reason for its adoption. The main sewer of the town is for a distance of about 1400 yards from the outfall towards the town below high-water level, and in consequence of this, like many other coast towns, it is for some hours in the day tide-locked. This causes the sewage to back up and lie stagnant in the lower part of the town, there not being sufficient time between high and low water for the whole of it to pass away. It was therefore resolved, upon the author's report to the Board, to adopt Mr. Isaac Shone's ejector system, which, by the use of compressed air, will maintain a constant flow through the outfall sewer both at high and low water. The arrangement by which this is effected the author will now proceed to describe. The air for supplying the ejector is compressed by two 14-inch "compressors" invented by Mr. Thomas Sturgeon. These are worked by a pair of high-pressure expansive and condensing engines (the cylinders of which are $10\frac{1}{2}$ inches in diameter), fitted with the Hon. Charles Parson's patent variable expansion

gear and equilibrium piston slide valves, the engines being arranged so that they can be run either separately or together, and capable of working to 450 feet piston speed. The steam is supplied from two "Kesterton" boilers, provided by Messrs. Tangye Brothers, of Birmingham. The compressed air is passed to the three ejectors for a distance of about 350 yards through 6-inch cast-iron flange pipes, and at the same time air is being stored in the receivers for use during the night if required, thereby effecting a great saving in night labour, and at the same time keeping the ejectors constantly supplied. A reducing valve is placed at the compressing station to regulate the pressure of air required by the ejectors. A connection between the air receivers and the governor is also made, which, when the pressure in the receivers rises to a certain height, cuts the steam off from the cylinders of the engines and stops them, opening again and allowing the engines to run when the pressure lowers. Air from this station can be carried to any number of ejectors placed at different parts of the town, and at any distance from the compressing station.

To pass on to the actual disposal of the sewage. The main sewer, by means of a penstock, is diverted from the direct outfall to the sea, and conducted to the ejectors, which then proceed to work. These consist of hollow cylindrical vessels, 4 feet 6 inches in diameter by 5 feet high, which are placed entirely below the level of the sewer, so that the sewage passes by gravitation into them through an 18-inch inlet pipe placed on the town side of the penstock. Inside the ejectors are two small cylinders, each being open at one end. The upper one, which is termed the "bell," is suspended with its open end downwards, and the lower one, termed the "cup," with its open end upwards, so that the latter is always filled with sewage. The "cup" and "bell" are connected by a rod, and a small rod passes from the upper one, the "bell," through a stuffing box in the cover to a lever which acts upon a small slide valve governing the action of the automatic piston valve, so as to alternately admit compressed air to the ejectors and let it escape. When the ejectors are nearly full, the sewage, as it rises, encounters the "bell," closes up its open end, and compressing the air within it, lifts it up, thereby drawing back a small slide valve, admitting air pressure to one, and exhausting at the other end of the automatic piston valve, the outer ends of which act as the motive piston, the middle portion acting as the valve regulating the inlet and exit of compressed air. The piston valve being thus moved

over, opens the port admitting compressed air to the ejector, which forces the sewage out through a delivery pipe into the sewer, on the sea or outfall side of the penstock, ball valves being placed both on the inlet and outlet pipes to prevent the back flow of sewage. The "cup" and "bell" arrangement being balanced, and the weight of sewage in the cup being neutral so long as it is submerged, retains its position until the ejector is nearly empty and the sewage begins to pass below the cup. The dead weight of sewage in the cup then acting downwards pulls the cup and bell down, reversing the small slide valve and so shooting the piston valve over to the opposite side, shuts off the compressed air and opens the ejectors to the exhaust. The compressed air at once rushes out, allowing a fresh charge of sewage to enter the ejectors, and the action is repeated. Valves are placed both on the inlet and outlet pipes of the ejectors, so that they may be readily disconnected and worked separately.

In conclusion, it will be seen by this that the action of the ejectors is entirely automatic and depending upon the rate of flow of sewage. In full work each ejector will fill and discharge in one minute; but during the hours of minimum dry weather flow the ejectors will be much longer in filling, thus doing only as much work as is actually required. The population of Eastbourne is 24,000, and putting the quantity of sewage to be disposed of at 40 gallons per head, the amount of sewage to pass through the outfall sewer will be 960,000 gallons per day. As has before been mentioned, the ejectors are capable of filling and discharging once in each minute, and their combined capacity being 1500 gallons, if the engines run 10 hours per day, they will dispose of 900,000 gallons in the 10 hours, air being stored at the same time in the receivers at six effective atmospheres. The receivers will contain at this pressure 50 charges, each of which will eject 1500 gallons, making a total of 75,000 gallons which can be disposed of automatically during the night; the average thus disposed of by the ejector during the day and night amounting to 975,000, or 15,000 gallons in excess of the present requirements. *

A discussion followed the paper, after which the Members dined together at the Queen's Hotel.

DISTRICT MEETING AT STOCKTON-ON-TEES,

September 24, 1881,

*Held in the Council Chamber, Stockton-on-Tees, Mr. A. M. FOWLER,
M. Inst. C.E., Borough Engineer, Newcastle-on-Tyne, in the
Chair.*



THE Members, having assembled at the Town Hall, first proceeded to inspect the tramways, which are near completion, and then, accompanied by Mr. Alderman Dodds, M.P., and Mr. Councillor Dodds, proceeded to the works of the Stockton Forge Company, where they were met by Mr. Panton, the general manager, who acted as cicerone. The various departments of these works being in full operation, the Members had the opportunity of viewing the various details of all the sections, each process being minutely and courteously described by the manager.

At the invitation of Mr. Dodds, the Members then partook of luncheon. Other works of interest having been visited, the Members returned to the Town Hall, where the following papers were read and discussed :—

LUSTRUM BECK DRAINAGE SCHEME.

BY JAMES HALL, BOROUGH SURVEYOR, STOCKTON.

About four years ago complaints were made as to the state of a portion of a stream forming the north and part of the west boundary of the borough, called Lustrum Beck, by several of the riparian owners, to the Local Government Board. That body communicated with both the Urban and Local Authorities, and the writer was instructed by the Urban Authority to prepare a scheme to remove the sewage by a fresh channel into the river without at all entering into the beck.

Several plans were proposed, all of which, however, were strongly opposed by the officials of the Tees Conservancy Commissioners, on the ground that all unclarified sewage tended to silt up to a great extent the bed of the river. The Corporation thereupon instructed the writer to prepare a scheme for taking all solid matter from the sewage; such is the scheme which will now be explained.

At first a small scheme was proposed merely to deal with the actual sewage discharged direct into Lustrum Beck, but as the question of increased sewer accommodation was one which would require to be considered at an early date, the writer was instructed to prepare extended plans.

The original estimate for proposed works, including land, sewage tanks, engines, and the necessary buildings, was 3407*l.* 10*s.* 5*d.* The annual cost, including interest and redemption, was estimated to be 368*l.*—equal to a rate of $\frac{2}{3}$ *d.* in the pound.

The more extensive scheme is the one the writer wishes to draw your attention to. It is proposed to construct a double sewer, 1302 yards in length, each barrel being 2 feet 6 inches in diameter, with manholes at intervals, to distribute the discharge to a series of tanks five in number, 99 feet long, 15 feet wide, 5 feet 6 inches deep to water level, and 14 feet to top of wall. Each of those tanks will be fitted with a strainer, consisting of two perforated plates of cast iron and filled with breeze; each tank will contain when full, 53,380 gallons of sewage.

The sewage will be carried to the tanks by an open carrier, with

proper sluices and valves, so arranged that any of them may be closed as required.

A storm overflow will also be constructed to take the sewage when diluted with a large quantity of storm water directly into the beck, or to the pumping well, as may be required, without passing through the tanks.

After being clarified, the sewage will be raised to a height of about 24 feet into an iron cistern or tank, out of which it will flow by gravitation into the river, a distance over 1967 yards, 1077 of which will be cast-iron pipes 1 foot 6 inches in diameter, in which the sewage will be under such pressure as it receives from the head the cast-iron cistern's level gives it. The sewage will then flow with an easy gradient through 1 foot 6 inch sanitary pipes to the river, where a tidal flap will be fixed.

Arrangements are made by which the tanks can all be regularly flushed out and thoroughly cleansed.

It is proposed to dig into the land adjoining the works (which will be purchased) as much of the solid matter as is not sold, and it is hoped that it may yield a fair profit.

Workmen's dwellings, stables, &c., will be erected, and roads made to the works.

Storm overflows will be provided, and also a sufficient number of manholes, inspection shafts, and lampholes, as may be required.

The estimated cost of the works is 10,737*l.* 17*s.* 11*d.*—say 10,738*l.*

The writer does not lay claim to any extraordinary features in the scheme so briefly explained, although some of the details are original. Time will not allow any longer description of the proposed works. The plans and details are open to the inspection of all the Members, and should they, by the remarks made in this paper, invoke a discussion which may be of use to any or all of us, the object sought for will be attained.

PRIVATE SEWER CONNECTIONS AND HOUSE DRAINAGE WORKS.

By H. U. McKIE, Assoc. M. Inst. C.E.,
CITY SURVEYOR, CARLISLE.

In olden times the method of draining houses in England appears to have been principally a surface drainage, and, as seen in the old castles and keeps, each storey had its convenience, termed "garde-robe tower," for getting rid of the excrement and refuse, having a louvred flue running up from the bottom to the top of the building, the louvre on each story being a protection from the excrement falling into the closets in the storey below them.

There does not appear to have been any provision for the prevention of the stench arising from these flues, except by the strong draught of air that found its way up the flue, and the emptying of the wood and peat ashes from the fires, and probably the soot-bags, down the flues; if this were so, it is to be hoped that each closet would be protected in some way, to prevent the ashes and soot from entering those above and below them. As wood and peat ashes are very light, the probability is that any excrement adhering to the sides of the flues would be covered by them and form a deodorising dust to sweeten the flue and assist the atmosphere in deodorising the refuse thrown or deposited down them.

In the old warlike times every man's house would have to be, in every sense of the word, his castle, and he would have to make provision within its four walls for getting rid of all refuse in the best way he could, without exposing himself to the attacks of enemies by going outside the walls. It is very probable that if an enemy had found his way into the castle he would have been (if not too strong to resist the owner) tumbled down these wide, spacious flues, and, if this were so, it would not be a very clean backdoor exit. Be this as it may, I can only say I have often seen the arrangement named in old castles and keeps, and Mr. W. H. C. Stanford informs me he has seen some farmhouses which now have these flues in use, and do nothing to deodorise them except to empty soot-bags down

them periodically ; this, and the up-current in the flues, keeps them in a better condition than the more modern but badly-planned privies.

As far as I have examined the old excrement flues in castles, I have not in any case found signs of a sunken cesspool to receive the excrement, but it appears to have been left freely exposed to the atmosphere, and in some cases to have discharged itself down the steep bank adjoining the outside wall of the castle, to be frozen by the frost, baked by the sun, or purified by the atmosphere, and if this rude, rough and ready way were adopted to get rid of the excrement, bad as it is, it would, in my opinion, be better than the old privy with its deep-sunk cesspool, full of fermenting, putrefying, maggoty matter, with a hole at one end designed to empty it out once or twice a year, but which also acted as an inlet flue to fill the privy with bad stinking air the moment the door was opened, or the lid removed from the seat, should such a refinement be indeed in existence.

Respecting the old fortified towns and cities, I do think that there were originally detached privies, at least from the accompanying old plans of the City of Carlisle (the small one made by Speed, some time between the years 1542 and 1629, and the larger copied from an old plan in the British Museum). There does not appear to be in the gardens, or near the houses, any detached small buildings which might have been used as privies. The absence of them proves, in my opinion, that the owners would have to make some such provision as I have before named for getting rid of the excrement and refuse of the houses within the four walls.

In the south of France the privy accommodation in the villages is anything but pleasant or satisfactory. Often a large room on the ground floor is set apart for this purpose, with a square cesspool in the centre, which is the common receptacle for all excrement, refuse, and filth of the house. It is often unprotected even by a rail, or if there is one, or an apology for a seat, it is generally in such a decayed state that it cannot be used with safety. This rude, unsanitary plan appears to me to have been originally devised because, in bygone times, it was only safe to have within the house such places to prevent the necessity of going outside the walls of the building.

How health was preserved in the olden times in our ancient Border City of Carlisle, or other old walled towns, I do not know. In carrying out the main sewers, as resident engineer for Mr.

R. Rawlinson, C.B., I found the subsoil of the city (in some cases for 15 feet deep and more, without coming to the natural subsoil) to be composed of house refuse of all sorts, and so full of bones that men and lads collected them for sale and made good wages by doing so. I expect this state of things, to some extent, is the same in all old walled and fortified cities. What I myself saw and described at the time fully bears out the paragraph in Mr. Rawlinson's report in 1850, on the subsoil of Carlisle, or "forced earth," at page 9, namely, "In the eventful history of the city, plague has at times raged so formidably, and swept away such multitudes, that the living were scarcely sufficient to bury the dead; so that the sword, fire, and plague, have heaped desolation upon desolation, until the present city stands upon piled ruins. Ancient walls, pavements, floors, graveyards, and coins, are found beneath the present surface at varying depths of 5, 10, 15, and 30 feet. The whole subsoil is one mass of ruins, locally known by the name of 'forced earth.'"

When I first went to Carlisle in 1854, to carry out the sewerage, house drainage was almost nil, except open channels. Public sewers were few in number and very imperfect in construction. The length of public street and other channels contaminated with sewage matter (see Mr. Rawlinson's Report on Completion of Public Sewers, 1856, page 9) was as follows:—

		Miles.	Yards.
Contaminated	public street channels	17	283
„	private yard channels	10	1570
„	suburban channels and ditches	6	380
	Total length in miles	34	473

This length of open channels and ditches, some of them having very little fall, tainted the atmosphere to a dangerous extent, as the most objectionable matter was emptied into the channels from public streets, private lanes, and courts; but these have now all been done away with or relieved of sewage matter.

Mr. Doulton states in his paper on Stone Ware, read before this Institution, that the first salt-glazed sewage pipes (if we put on one side any field drainage pipes that may have been used for that purpose) were made by their firm in 1846, the idea of making them originating with Messrs. John Roe and John Phillips.

Then commenced the battle between pipes and bricks, and sur-

veyors and engineers were, by one section or another of the profession, taken to be wise or foolish men simply because they advocated the use of bricks or pipes for sewers and house drains.

Passing over this strong, breezy, severe, but healthy time of the ventilation of these different systems of drainage, opinion settled down (as in the battle of gauges on railways) to a combination or average of the two, or a system of brick and pipe sewers and drains, which I think is now wisely followed by many engineers.

The passing of the Town Improvement Act in 1846, and the Bluebooks of that time, gave an impetus to the better sewerage of towns, and the removal of refuse from houses.

Among the first towns to carry out the Town Improvement Act, were Alnwick and Lancaster. My old partner, Mr. John Lawson, and myself being acting engineers for the water and sewerage works of Lancaster, under Mr. R. Rawlinson as chief engineer, and Mr. Rawlinson being also engaged to carry out the water and sewerage works of Alnwick, it was arranged that I should take in hand to act as resident engineer of the works at Alnwick; Mr. Lawson, being a native of Lancaster, carrying out at the same time those works at Lancaster.

Alnwick was the first town to adopt straight lines and levels, with manholes, and lampholes or inspection chambers, at each alteration of line or gradient in the public, and straight line and levels in the private sewerage, as well as being the first to adopt fixed sight rails and the string line between them; every pipe being laid perfectly true in gradient and direction, the first being done by a boning rod, and the latter by a plumb bob, adjusting the direction of the pipe with a plumbed line from the straight string stretched over the centre line of sewer fixed on the sight rails, three or four of these fixed sight rails being put up at one time, and the straight line carefully nicked on each side of them after they had been tested and set at the right gradient.

This plan was suggested to me by my experience when a pupil under Mr. Lamb, of Hay Carr, near Lancaster, the agent for the Duke of Hamilton's large Lancashire estates. Mr. Lamb having given into my charge the responsible duty of seeing all the field drains on the estate carefully and accurately carried out, both as to line and level, Mr. Rawlinson, to whom (in my weekly report to him on the Alnwick works) I suggested

that this system should be adopted in sewerage the town, saw the practical utility of the idea, and with his usual courtesy at once consented to its being carried out, and ever after made a point of adopting it in all his works.

I may perhaps be allowed to say that during the whole time I carried out sanitary works under Mr. Rawlinson, I always found him ever ready and willing to give me every information I required, and to take an amount of pains in encouraging the developing of the present sewerage system, worthy of the deservedly high repute he now has in all sanitary matters. I have always received from him, up to the present time, the greatest kindness, fatherly advice, and evidence of true interest for my welfare; this I feel assured will be endorsed by all engineers and surveyors who have carried out faithfully, and to the best of their ability, works entrusted to them by him.

In carrying out the works at Alnwick I was fortunate in having a fine class of workmen to superintend, who had been thoroughly instructed in the cutting of field drains on the Duke of Northumberland's estate, men to whom it would be as difficult to execute a crooked drain, either in line or gradient, as (in my after experience I have found) it is for some men to make, from want of knowledge, a straight lined, or true graded drain, without the constant supervision of myself or an inspector.

Now let me draw more particular attention, as far as my experience goes, to what has been done in the way of private house drainage in the last thirty years. From the commencement at Alnwick no drain, except those connected with water-closets in the house entered the house; all the kitchen sinks, slopstones, and butler's pantry, &c., were disconnected at the outside wall of the house, and delivered, in the first instance, on to a bell-mouthed trap, fixed in a stone or earthenware casing, this being the only trap at that time available for the purpose, and afterwards on to the old Stockton or earthenware syphon-trap gullies. This system of disconnecting private drains from houses was also carried out in Carlisle.

I however improved the old Stockton gully by making the cover hopper-shaped, so as to leave a less surface of water exposed to the atmosphere, and thereby preventing the gully from being so rapidly made trapless by evaporation, the surface of the water in the sludge-box being five times greater than the part exposed to the atmosphere. These gullies were made from drawings prepared and designed by

me, and I got a pattern-maker over from the Phoenix Foundry at Lancaster to make the patterns for them in my office and under my own supervision.

In these improved gullies I also introduced a second water-trap under the sludge-box, thus making them double water-trap gullies.

For a long time these gullies were made by the Phoenix Foundry Co., of Lancaster, who had the contract for cast-iron pipes and iron work for the Carlisle main sewerage works. The gullies were extensively used in the northern counties, and called indiscriminately McKie's or the Carlisle gullies.

They were afterwards made by Mr. Daniel Clark, of Carlisle, who, in addition to making the double-trap gully, made also a triple-trap gully. Since that time they have been called Clark's gullies.

In carrying out the sewerage works at Alnwick and in Carlisle, the house sewers were ventilated by the down water rain spouts, when these were not situated near windows or openings into the house above them.

Respecting the old privies converted into water-closets, a mistake was made at Alnwick at the commencement by using the common sanitary water-closets, and not disconnecting them by a service-box cistern from the water-service main; and there is no doubt that the back draught when the water pipes were emptied would not be a sanitary improvement, and has been justly condemned.

With this exception, and the more perfect ventilation of the sewers and better appliances for flushing and of ventilating trap, no considerable improvement in principle has been made from that date.

Even with the faults named above, where the private drains have been carefully carried out, they are an improvement on the older method of disposing of the excrement and sewage from the houses, insomuch as all sewage is immediately removed from the premises.

I introduced also at Carlisle, when the private drains were commenced, in 1856, the Macfarlane trough water-closet, which had the same fault as those named above, of not being thoroughly disconnected from the water-service pipe.

They however, were of great service in giving a good flush to the house drains, and acted fairly well; but it was found, when not properly treated and attended to, they became, in tenement property, a nuisance, as all sorts of foreign substances were indiscriminately put into them by the tenants, and in consequence

they became almost continually choked up. They have therefore been replaced with more suitable sanitary closets, properly disconnected from the water-service pipes by approved water-service box-cisterns.

Respecting the trough water-closet, I have seen a drawing of one self-acting. For tenement cottages, public institutions, and public water-closets, they may perhaps in the future be more successful, but they will have to be in some way disguised from the original trough, as the dark hole under the seat appears to be, to some of the parties who visit public closets, an irresistible receptacle for every conceivable thing that they may want to get rid of, and that will go through the seat hole.

Before I did away with public trough water-closets, it was not an uncommon thing to find the closets or pipes stopped up with old clothes, boots, &c., thrown down by some poor workman, who, going about from place to place to find work, upon being successful, selected the closet as the best dressing-room he could find in which to get rid of his old clothes and don others more respectable.

Besides the above articles the closets were not an unfrequent receptacle for bones, scraps of meat, and broken bottles, as well as the hundred and one things children will put down such places.

Without for one moment finding fault with respectable building firms, to whom I would with all confidence entrust any building contract, feeling satisfied that they would not allow any "jerry" work and would at once discharge any workman scamping his work, I feel convinced in my own mind that, until the workmen employed by them are made thoroughly acquainted with the importance of all sanitary arrangements being carefully carried out, and made as good, tight, and sound, as hands, materials, and brains can make them, it is undesirable to entrust the execution of private drainage works to builders.

I say nothing as to "jerry" builders who will scamp everything they can, both above and below ground, and whose only object is to build and dress in a cheap showy way the houses they construct, that they may be attractive to the eyes of those who buy them. Bad material, insufficient strength, scamped drains, and imperfect sanitary arrangements, are to such parties all alike. The health and comfort of those who subsequently purchase or occupy these houses does not for a moment enter their heads; their object is to get the house off their hands as quickly as possible, with as little cost in construction as they can devise, contrive, or find out.

Then there is another class of men, I cannot call them builders, they are generally hard-working, plausible men, who, as soon as the public sewerage of a town is completed, run down the authorities and their officers as the most extravagant, reckless, and expensive men in the world. These men, who profess to know everything connected with sanitary matters, go about touting for orders from house owners, and undertake to put in their private drainage works at half the cost the authorities will do the work for; the consequence is, that the private works carried out by these men are a curse to the town, and by being improperly and carelessly executed, cause an amount of extra expense, sickness, and death, which it is difficult, if not impossible to calculate.

Then again there are authorities who anxiously and conscientiously desire that all the private works should be well done, but who let these private works which they are requested to carry out by public competition, instructing their surveyor to prepare, with all the care and knowledge he may possess, a specification of the works, and a schedule of prices for the parties tendering to fill up; the consequence is, that these contracts are taken by undesirable men, who care nothing for the class of work they put in if they can over-match and deceive the diligence of the surveyor. I know it will be said, Why employ a surveyor who can be either over-matched or deceived by a contractor? Discharge the incompetent surveyor and engage a man who can carry out the specifications to the letter, and is competent to manage any contractor. Yes, all right, get the man by all means, who is able and willing to do this work single handed, if you can; many have attempted it and failed, and been put down as muddle-headed, nervous, irritable, brainless, and unbusiness-like fellows, who know no more about work or the management of men and contractors than the man in the moon. Yes, I have known such a man who tried conscientiously to do it, and who broke down and had to run away for a couple of days to gain his feet and clear his head, and when he returned to do battle again, was looked upon as some curious specimen of humanity, because in his temporary absence the report had industriously and maliciously been circulated by an unprincipled man, that he had been taken to a lunatic asylum and was past all hopes of recovery, that the sooner the town got a man for surveyor who had brains, and who would not always be at loggerheads with the contractors, the better, as no contractor could do work to suit the man who was then surveyor.

I say it matters little whether private works are carried out by a contractor, under the authorities, or by the builder, or working field drainers, if the authorities will not allow the surveyor to have a competent reliable inspector to act under his instructions and to see his specifications and the contract carried out carefully, strictly, fearlessly, and correctly in all its details.

It is my opinion that if the sewerage works and sanitary improvements of a town are not to become a curse instead of a blessing, more attention must be paid to private connection and house drainage. That the work should be done under the authorities' surveyor, but seeing that he has other important duties to attend to, he should have under him a competent and reliable inspector, or inspectors, to see that the works are faithfully executed. I say inspectors as well as inspector, because if the private drainage is going on in different parts of the town, one inspector cannot overlook and superintend a dozen gangs of contractors' workmen at the same time.

It is my belief that the best and only way of having house drainage carried out satisfactorily, is for the surveyor, and the inspector under him, to educate and instruct the workmen, so that it shall be as difficult and as much against the nature of such able, trustworthy workmen to execute work not in every way satisfactory (as I said in the beginning of this paper) as it is difficult, without strict and constant supervision, to get men who have been allowed to do work carelessly into the habit and practice of doing it well.

Now let me say something about materials in private drainage works.

What would be thought of a gas engineer, or manager, who allowed materials to be used and workmanship to be done that would cause escape of gas and probably a blow-up of the house in which he had laid on gas? or the water engineer, or manager, who laid on water to a house in a way that was found faulty? Why, the bad work would at once be found out, and would not be tolerated for a moment, but would have to be put right. The gas manager would be asked if he intended to suffocate or blow up the inmates; and the water manager, if he intended to drown them out or make the house damp and unhealthy.

Far more dangerous are bad materials and bad workmanship in house drainage, and which are not so easily at the first found out. Granted that at this date no surveyor would allow drains in a house except it be for a water-closet, which must be made as tight as a

water or gas pipe, what about the drains outside the house—the connection of soil pipes with the drains, gullies with the drains, badly jointed sewer pipes, or imperfectly laid pipes, both as to line and level? My own opinion is that our ordinary sanitary pipes are not sufficient to prevent the possibility of leaky joints, from which sewage matter and sewer air may, and do escape, and find their way into the houses, causing sickness and death, when the occupiers are told and fully persuaded that the sanitary arrangements are all right.

I am aware that there are a number of patent jointed water-tight pipes now manufactured, and until these, or some other more perfectly formed sanitary pipes are used, we may expect to find imperfectly jointed pipes, which will saturate the subsoil below the pipe with sewage, and above it with sewer gas, and these will eventually find their way into the houses and cause illness and death.

From these causes and from pipes inside dwellings, and under covered passages, a great evil exists, which must be removed before the sanitary condition of a house can be made satisfactory.

Now respecting soil, ventilating, and water pipes.

Respecting soil pipes, you have before you drawings showing portions of two old lead soil pipes. I had them sawn off old soil pipes which have been replaced with new ones. The pipes speak for themselves, and as, at the same time, I had to replace about 80 feet of defective soil pipes, I think it is time some other substance than lead should be introduced for pipes.

In October 1878 I made some inquiries as to lead pipes, and had some correspondence respecting same.

Mr. John Corbett, of Carlisle, gave me the following statement concerning a lead pipe he had to take up and replace with iron, as follows:—

“In August 1862, I was engaged to lay down a new water-service main of cast-iron pipes from a spring, distant more than a mile from the mansion house of Netherby, the residence of Sir F. U. Graham, Bart., for the purpose of supplying that mansion and its adjoining premises with water. The cause of this new service pipe being required was that a lead pipe which had been put in for that purpose a long time ago had almost ceased to discharge any water at all. The reason of this was soon manifest when we took out the lead pipe, as we found the following state of things to exist, viz. from careful measurement of the pipe it would be, when it was

put in, $1\frac{1}{8}$ of an inch in internal diameter and $1\frac{9}{16}$ of an inch in external diameter, and when taken up, the inside of the pipe was so much filled up, that only $\frac{3}{8}$ of an inch in diameter remained for the discharge of water. The deposit on the interior of the pipe was as follows, viz. attached to the inside of the pipe was a hard substance of light cream colour, $\frac{2}{3}$ of an inch in thickness, and on this another layer was deposited of $\frac{3}{4}$ of an inch thick, of the same colour, and of the hardness of chalk, and again another layer was deposited on it $\frac{6}{12}$ of an inch thick, of a soft granulated substance, of the same colour, and of the consistency of a soft adhesive paste, in fact it could be worked in the hands like putty. These substances deposited on the inside of the pipe were extremely poisonous, as was proved by the death of two head of cattle, and the narrow escape of several others that were grazing in the park, through which the pipe was taken in a sunken trench. To account for the cattle getting this substance, it will be necessary to describe the way in which the lead pipe was taken out of the trench. After the iron pipe had been completed, the lead pipe was cut into lengths of 18 feet, then coiled up and thrown on the grass at the trench sides, every time the mouth of the coil came round in coiling, a large quantity of the softer portion of the substance was discharged, and in this way became distributed over the surface of the ground, causing the grass to sprout up fresh, and quickly enticing the cattle to eat it, and at the same time getting a quantity of this substance. After the cattle were dead this was found in their stomachs. I had it analysed, and it was pronounced to be the same substance as that discharged from the lead pipe."

At the same time I was informed that Loch Katrine water had been found to act injuriously on lead pipes, and that Mr. Napier of Glasgow had patented a pipe composed of alloys of metal as a substitute for lead, but this I have not heard anything of since.

I had also at that time correspondence as to iron pipes, which are acknowledged not to act injuriously on water, and I drew attention to Professor Barff's method of coating iron with black oxide of iron as a preventive of rust.

Since that time some considerable steps have been taken in the method of coating pipes, and lately, on writing to Professor Barff's agent, I found that his patent and Mr. Bower's have been amalgamated, and that Mr. Bower is now making preparations to coat iron on a large scale, and the combined process is to be called the "Anti-Corrodo."

I have had some correspondence with Mr. Bower, and he has coated a number of pipes and other articles, as well as the box containing them, and which I now produce.

These I have had tested with strong acids and herewith beg to give you the result.

A small portion of the coated iron was first filed, so as to expose part of the uncoated metal underneath, it was then heated in a gas jet to a "black heat." The several acids were applied to the filed portion, and also to the coating surrounding it, with the following results:—

1st. *Strong* Sulphuric Acid acted on the uncoated iron quickly, but very slightly upon the coating, simply dissolving the small particles of loose carbon on the surface of the coating and leaving a kind of water mark.

2nd. *Dilute* Sulphuric Acid (1 in 12), when placed upon the filed portion of the pipe, was distinctly seen to act on the iron but had no effect on the coating.

3rd. Nitric Acid acted briskly upon the iron, but had no effect upon the coating.

4th. Nitro-Hydrochloric Acid had no effect upon the coating, but acted briskly upon the iron.

The above information was furnished to me by Mr. T. Martlew, chemist, who informs me that the coating was only subjected to the acids for a short time.

The following is a letter Dr. T. H. Walker, our city analyst, has kindly sent me respecting the coating of the pipes:—

"I have much pleasure in giving you what information I can, but I am afraid I cannot give you any information (about the coating) that you do not know better yourself. It is a combination of oxygen with the iron itself, differing from ordinary rust in containing nine equivalents of iron instead of eight combined with an equal quantity of oxygen. I think it has given satisfaction so far, and has been found a success; but you will gather more about it in your engineering papers than I do. Specimens were exhibited at the Iron and Steel Institute, and a paper read on them. The specimens had been exposed for years to the influence of air, water, and salt water.

"There is one important advantage that has not, I think, been pointed out, i.e. the co-efficients of expansion of this magnetic oxide and of iron itself are practically alike; when there is a great difference between the metal and its coating, the constant contrac-

tion and expansion of the metal must tend to separate the coating from the metal; moreover, in this case the coating is part and parcel of the iron itself, not simply on the surface. I have exposed for twelve hours the tube in an atmosphere containing euchlorine; this sets free oxygen in its most active condition, i.e. as ozone. I put also a piece of tinfoil and bright iron wire in with it; the wire was rusted through, the tin much rusted, and a part of the iron tube, where I had purposely exposed the iron, much rusted. The rest of the tube was all right, except two or three places where I think the coating was defective, any way there were two or three places rusted pretty deeply. From my experiment, I should certainly like to try another tube or two before I gave it unqualified approval; but where the coating is perfect, I have little doubt it will be an absolute protective."

Should this process answer the expectations which the experiments up to the present time would almost justify, we shall have one of our cheapest and the most useful of metals made rustless, and for all ordinary uses to which it is applied, practically indestructible. It is almost too good news to be true, but if it be so, we shall have sewer, soil, water and gas pipes, and all the different sanitary appliances, some of which have to be made of much more expensive metal, brought down to a more reasonable cost. They will also be of greater utility, and, let us hope, free from all poisonous effects, either by the pipes being riddled into holes, as in the drawings of old lead soil pipes before you, causing death by distributing into our houses sewer air and deadly gases, or danger in the water from the action it has on lead pipes.

I have not been able to reconcile to myself the safety of having water-closets in houses, from the difficulty of guarding against leakage in the pipes, and the danger of admitting sewer air through the houses; but given practically indestructible pipes, good ventilation, and a careful selection of the site of the water-closet in the house (which I think should always be, at the least, against an outside wall, and, if possible, broken from the living rooms by double doors, and an intervening conservatory or fernery), I think they might be introduced into dwellings without any dangerous results to health. If, however, owners of houses will continue to have water-closets in the centre of the buildings, and hidden in out-of-the-way corners, difficult to ventilate, coupled with the danger hitherto from defective soil pipes, I see no remedy against them becoming injurious to health. This matter I drew attention to in my report

on ventilation of sewers and drains to my Sanitary Authority in 1878.

In 1870, I took an old manor house (near a small town amongst the Welsh mountains) beautifully situated on a hill, and conveniently arranged, the very place any one would pick out for health and an enjoyable home; but what did I find? Almost the entire front of the house surrounded by shallow, dry rubble walled, open-jointed, and almost level drains, nearly full of fermenting sewage matter, with two ordinary brick drains close beneath the flags in the house, one running to the kitchen slop-stone, and the other to the butler's pantry sink, and both placed against the opposite outside wall of the house. I also found innumerable rat-runs from the drains to the fire-places, and in almost every direction through the house on the ground floor, with passages through the old walls to the rooms above, and a water-closet badly constructed and unventilated. It cost me over 80*l.* to put the house in moderately fair tenable condition. The drains had all to be taken up, the fermenting sewage matter mixed with quicklime and removed, the old drains filled up with concrete, new drains made, and the water-closet renewed and ventilated above the ridge of the house, having a 6-inch iron pipe with a cowl on the top. Was it surprising (as I was afterwards told) that the house had a bad name for being very unhealthy previous to my occupation? I am afraid that if the old country houses were examined, that many of them would be found in a worse sanitary condition than town houses. All old houses built before 1846, when stoneware sanitary pipes were first manufactured, should have their sanitary arrangements overhauled.

To come down to the present practice of house drainage, I do not wish to go fully into the headlong fever heat now raging, and perhaps an over refinement respecting house drains and other sanitary arrangements. I however submit to you drawings of what some engineers have thought it requisite to do in this matter so far as I could get plans of works actually carried out.

First you have before you plans and sections I have lately carried out of the drainage, ventilation, and warming of a country house. The drawings will in a great measure explain themselves.

The sections and the manholes will show you that the system of free ventilation has been carried out. You will notice that at A and B syphon traps have been put in the main drain, to prevent sewer air from the main drain having free passage into the house.

The syphon traps are ventilated at both sides; at the low side to a considerable elevation (about 40 feet) above the ground, with a 16-inch Boyle's ventilator on the top, and at the high side, at the surface of the ground, for inlet to secure through ventilation.

That no sewer pipes are allowed to enter the house except the soil pipes for the water-closets; that in each case the connection is broken at the outer wall of the building, and a self-acting Field's flushing chamber placed at the head of each drain, which is supplied with water to give at least three flushings a day. That all the soil pipes are carried to the ridge of the roof and ventilated with a 16-inch Boyle's ventilator. That, in addition, a ventilating pipe 4 inches in diameter is carried to the top of the tower at C and ventilated with a 16-inch Boyle's ventilator.

That all the drain pipes entering the house are disconnected, and ventilated with 4-inch screw-jointed galvanised pipes to the ridge of the building.

The water-closets used are Doulton's No. 13 closet, with a syphon trap at the bottom. The kitchen sink has one of Field's earthenware self-acting flushing chambers. All the manholes are free, open ventilating manholes.

That the sewers are laid in straight lines, and have good gradients. That manholes and inspection chambers are placed at each end of the straight lines, and when there is a change of gradients.

That the baths, sinks, butler's pantry, and housemaid's closets have separate and distinct pipes, and the connection broken at the outer wall of the house.

That, as the principal roof is composed of ridge and valley roofs, with skylights and windows above it, all the rain-water pipes from it are carried into a clear-water drain.

That the old stone sewers have been opened out, thoroughly cleaned and disinfected, and in some cases used as rain-water drains, the remainder and the seven old cesspools filled up with concrete.

That the passages, entrance hall, and particularly the staircases at the top of each stair, have been ventilated and warmed with hot water pipes. Some of the principal rooms have also been so warmed in addition to the open fireplaces, and ventilated.

That by testing the ventilators with an anemometer, the soil pipe ventilating shafts are found to have an upward current varying from a very slight draught to a current of air passing up them at the rate of 370 feet per minute, according to the pressure

of the wind and to the difference of temperature at the top and bottom of the ventilating shaft.

That each water-closet, in addition to having its soil pipe ventilated, is also ventilated at its highest point or ceiling, and that a 2-inch ventilating pipe is carried from under the seat to the top of the ridge of the house in a separate shaft, with a Boyle's ventilator on the top, so as to cause a down draught through the hole of the water-closet seat, to remove all unpleasant smell when the closet is used, and to prevent any bad smell coming from the safe under the seat into the water-closet. From experiments, I have found that these ventilators cause a draught down the seat hole, varying from a very slight one to 410 feet per minute.

That the ventilators in the staircases, passages, &c., give a varying up draught from 250 feet to 540 per minute.

On testing the draught up the seat holes of the *old water-closets* before they were removed, I found a current of foul air coming up them varying from 30 to 200 feet per minute, which must have been very injurious to health, as from the situation of those water-closets this foul air must have gone through the house.

All the sanitary earthenware pipes used in the drainage of this house are Howe's patent water-tight jointed pipes which I used in 1878. I used three miles to convey water by gravitation, and found them to answer the purpose.

The ordinary jointed pipe, with the socket made an inch longer, would answer the purpose as well as the patent pipes. The method of making the joint is as follows:—A fillet of clay is carefully put in the far end of the faucet pipe, the spigot pipe then sent carefully and firmly home, when another fillet of clay is put on the outside of the joint (same as in lead jointed pipes), and run full of boiling pitch or other substance.

That the house is abundantly supplied with good spring water, with a pressure of 120 feet above the ground floor level.

Through the kindness of my old friend, Mr. Joseph Gordon, C.E., I am enabled to lay before you plans and sections of the method adopted by him in Germany for the drainage of houses; and by a careful study of these plans and sections, they will, I think, explain themselves without my entering into further details.

I will only say that the sanitary arrangements he has adopted appear to me to be as perfect as it is possible for them to be in dealing with existing buildings.

Mr. James Mansergh, C.E., has also been good enough to send

me a block plan of the drainage of his house, Lune Lea, Hampstead, and furnished the following description of the same:—

“The ground floor level of this house is 270 feet above O. D.

“It is situated on the southern slope of the Hampstead Hill, just where the capping of Bagshot sand rests upon the London clay.

“Within a hundred yards east and north-west were two of the springs thrown out by the clay which gave the name to this locality before it was laid out for building, viz. ‘Conduit Fields.’ These and other springs have gradually been dried by the cutting of sewers, into which the water has been turned, its quantity having previously been diminished by the conversion of the previous pervious sand surface into impervious house roofs, roads, and footways.

“The house is practically on two floors, there being only a basement or cellar floor under the dining-room and staircase, and a second floor in front over the dining-room, entrance, and breakfast-room. The cellar is paved with York flags on six inches of concrete, and under all the other ground floors of the house there is a well-ventilated space three feet high, the whole area being covered with six inches of concrete.

“The house branch to the main sewer is of six-inch best Lambeth stoneware pipes with ‘Stanford’ joints, the junction in the sewer has a hanging flap, and between that and the disconnecting chamber inside the garden wall the fall of the pipe is about 1 in 12. The bottom of this chamber is formed with a ‘Weaver’s’ syphon, with 3½-inch dip, set upon and surrounded by concrete. Above the vertical inlet to the syphon an 18-inch square brick chamber is brought up to the level of the ground and covered with an open iron grating on a stone curb.

“The 2-inch ventilating pipe from the heel of the syphon is brought up inside the chamber to near the top, but closed with a ‘Stanford’ plug. This might have been closed at the socket or syphon, because it was never intended to be used, but was brought up as described for experimental purposes; for I do not believe in ventilating public sewers by means of house drains, they should be ventilated effectively by appliances contained within *themselves*, and if possible, every house should be completely isolated, and have to deal only with smells (if there are any) *of its own creation*.

“In this case, the main sewer in the road has a rise of about 1 in 18, is well ventilated by open gratings, and I believe as a fact, the flap first and the 3½-inch syphon above are effective in preventing

the passage up the branch of foul air from the sewer. I have never been able to detect the slightest smell from the chamber.

"The 'sewer' (marked in red) is connected to the horizontal inlet of the syphon, and the 'rain-water drain' (marked in blue) is brought through the brick wall as shown, is protected by a close-fitting flap, and discharges into the vertical inlet of the syphon. The 'sewer' goes round to the north side of the house, and its first branch is from the lavatory on the ground floor, the waste from which is absolutely severed or cut off by means of a 'Mansergh' trap.

"The second branch connected with the 'sewer' is from the ground floor water-closet. This is a very short branch, and as the 'main' is well ventilated, all I have done is to bring back through the house wall a 2-inch pipe from a ventilating socket at the low side of the closet trap. The closet is one of Jennings' side outlets with vertical plug, and has given no trouble; but since I put it in, Doulton's have brought out their closet of nearly similar shape, with valve closing sideways, which I think, I prefer. The safe waste goes through the wall, and has a hanging flap to prevent back draught. The seat of the closet is hinged as well as the cover, so that all below can be readily examined.

"From the ground floor there are three more connections to the 'sewer.' The first from the scullery sink through a 'Mansergh' trap, the second from an outside servants' water-closet (a Doulton flush-out), and the third from butler's pantry sink on the west side, also through a 'Mansergh' trap. Besides these there are only two connections—from the first floor being, first, a soil-pipe from a slop-closet and a water-closet; and second, the waste from a lavatory and a bath.

"The first is treated as follows:—The soil-pipe is of 4-inch stoneware, 'Stanford' joints, carried up in a 9-inch square flue or chamber, and surrounded by concrete, this chamber being recessed $4\frac{1}{2}$ inches into the 18-inch house wall *outside*. At its head a lead hopper is fixed and neatly trimmed into it, and the trapped pipes from slop-closet and water-closet, which are at opposite sides of a partition wall, are turned down so as to drop their contents fairly into the stoneware vertical pipe. Opposite the hopper an iron door is fixed for inspection, and then, above, the 9-inch flue, well rendered inside, is carried right up above the roof, and finished with an 18-inch Boyle's extractor.

"Up to quite recently I have had here only a simple trumpet-

mouthed 9-inch pipe, as I have been waiting the report of the Committee of the Sanitary Institute on the question of cowls, before deciding what to put on, and with only this plain pipe I have never had a ghost of a smell inside the house.

"The next connection to the 'sewer,' from the lavatory and bath on the first floor is made thus:—A 2-inch stoneware pipe, with 'Stanford' joints, is carried up in a similar chamber to the soil-pipe outside the house, with a small hopper-head, into which the 2-inch waste from bath and lavatory discharges. The chamber stops a few inches above the hopper, and is covered with perforated air-bricks, and at the foot of the stoneware pipe is made good into a 'Mansergh' trap before joining the 'sewer.' This waste is therefore absolutely cut off, but to pass air through it occasionally, the stoneware pipe has a square junction upon it, about 18 inches above the ground, coming through to the face of the brickwork, which is generally closed with a turned plug.

"The *inlet* for air into the 'sewer' is at the disconnecting chamber in the front garden, and, to facilitate its entry, I had a junction put on a stoneware pipe the reverse of the ordinary way, and a pipe carried back and upwards to near the *top* of the chamber; the *outlet* is by the 'Boyle' extractor.

"The rain-water drain takes the roof water and surface water and drainage of the garden. Its outlet into the chamber is always closed by the flap before described, except when water is actually passing out, and an air inlet is formed on it from the chamber as just described for the sewer.

"There is a branch from 'rain-water drain' laid into the cellar, not for any special purpose, but to have an outlet in case of accident, but it is never used. It is finished with a quadrant bend about a foot under the floor, stopped with a 'Stanford' plug, and then well puddled over under a movable flag.

"The main and scullery cistern overflows pass straight through an outside wall, and all water-closets, bath, and lavatory safes, do the same.

"The wash-out pipes from cisterns discharge on to scullery sink, which is of glazed stoneware—much preferable, in my opinion, to stone.

"All the water-closets have independent service boxes, fed from main cistern, and I would here note that I quite agree with Mr. Hellyer that it would be better if these were made larger than they usually are. I always use mine twice, or more.

"I made one mistake at first, viz. by putting in a Jennings' combined lavatory and urinal, which with no amount of care could be kept *sweet*. After twelve months' trial I removed it as an unsavoury and an unsanitary abomination."

Accompanying this paper you have a tracing of the City of Carlisle which must have been made by Speed between 1542 and 1629.

Also another map, which was copied from a drawing in the British Museum, but it is not dated.

Also a map of Carlisle which represents the city when Mr. Rawlinson held his original inquiry in 1850.

Also a map made by Mr. Moss in 1880.

These maps show the growth of the city; and up to the present time the main sewerage works carried out by Mr. Rawlinson have been able to do the work required of them satisfactorily, with the necessary additional branch sewers put into the new streets which have been laid out since that date.

Plans and sections of house drainage works carried out by myself.


Plans and sections of house drainage works carried out by Mr. Joseph Gordon.

Two drawings of old lead soil pipes.

Block plan of the drainage of Mr. James Mansergh's (C.E.) house.

As water traps are proved to be ineffectual, I am of opinion we should not exclusively rely on them any longer. There are different patents taken out to prevent this defect by using balls or flap valves, the latter being hung almost vertically, so as to free them as much as possible from refuse, keeping them partially open. I have not had any experience in these traps. That some more effectual trap is needed than a water trap, or that it should be assisted by some other perfectly sealed trap, will, I think, be agreed to by all sanitary engineers and surveyors.

In a book by Mr. Joseph Parry, C.E., on Water, page 129, his remarks on this subject so fully agree with my own opinion that I have made an extract as follows:—

"1. That sewer gases will pass through water. Some interesting experiments on the passage of gases through traps were made a few years ago by Dr. A. Fergus of Glasgow. At the outlet end of a trap (a bent tube) he placed a small vessel containing the test solutions at the bottom of the  trap, and test papers at the top

of the S trap, the test papers were suspended. He found that ammonia passed through the water in from fifteen to thirty minutes, sulphurous acid in an hour, sulphuretted hydrogen in three to four hours, chlorine in four hours, carbonic acid in three hours.

"2. That traps may be emptied by evaporation. If traps are placed where the water is not frequently renewed, or if a house is long unoccupied, danger may arise from this cause.

"3. That if two or more traps are connected with the same line of pipe, the flushing of one may empty the others. There have been cases in which foul smells from wash-basins and sinks have been long complained of, and considerable expense has been incurred in seeking remedies, before the cause has been traced to the emptying of the traps by syphoning. To prevent this action, every trap should be properly ventilated. Waste pipes from baths, lavatory-basins, butlers' pantries, and housemaids' sinks should be brought to the outside separately, and not joined to soil pipes."

Though sanitary improvements are far from perfect, yet in the two towns I have been the most intimately connected with, namely Alnwick and Carlisle, in carrying out public sewerage and private drainage works, I find from information furnished to me by Mr. Wilson, the Town Surveyor of Alnwick, that the average death-rate before the works were carried out was 26·5 per 1000 per annum, and it is now about 18 per 1000 per annum. The death-rate in Carlisle before the sewerage works were carried out was on an average 29 per 1000 per annum, it is now about 22 per 1000 per annum, but a great percentage of the above 22 per 1000 is made up of the deaths of children under one and two years old, 23·5 per cent. of the deaths being children under one year old, and 33 per cent. of the deaths being children under two years old.

If the deaths of children under one year old are deducted it would bring the death-rate down to an average of about 17 per 1000 per annum.

If the deaths of children under two years old are deducted it would bring the death-rate down to an average of about 14·86 per 1000 per annum.

We should look forward to greater improvement in the death-rate than we have got, but it is not reasonable to expect that an old city like Carlisle, built on the refuse of ages, and full of narrow, badly-ventilated and over-crowded lanes and courts, should compare favourably with the death-rate of more modern towns. The death-rate in Carlisle last year from zymotic diseases was 3 per 1000, of

which 1·2 per 1000 were from diarrhoea, caused, our medical officer thinks, from eating unripe fruit, the death-rate from the latter cause being much greater than in preceding years.

I have tried to lay before you what I have myself carried out, and what I could gather my friends have done, on the subject of house drainage.

Every house should receive a careful study by the engineer engaged, to try and put it as sanitarily perfect as circumstances will allow.

If this paper will serve to ventilate the subject of house drainage and cause a discussion on the merits and demerits of the important subject of house drainage I shall feel satisfied.

By the interchanging of ideas we gain and give knowledge, and often have our crabbed, unshapely hobbies roughly put through their paces.

THE SEWER GAS NUISANCE AND ITS REMEDY.

By S. E. THORROLD, SURVEYOR, SOUTH STOCKTON.

That "prevention is better than cure," and that in matters of prevention "knowledge is power," all must admit to be truths ever in season and applicable in every clime.

When danger threatens any member of our family circle, no matter from what quarter it emanated, it becomes our duty to at once try to save them from the impending evil. Yet how many families are there, even in this age of progress, living, or rather existing, over a pent-up pestilence, in the form of defective drainage, allowing a free escape of sewer gas and specific germ poisons to enter their dwellings, ready to attack the members of the household. It is no doubt true that there are those who from indolence, indifference, or carelessness take little or no pains to avoid the danger, until a member of the family circle has fallen a victim to some form of zymotic disease. When this takes place, remedial measures are undertaken, perhaps in a panic, and when undertaken in this spirit, the end scarcely justifies the means, as the work is rarely carried out satisfactorily; it is a repetition of the old story of "locking the stable door after the horse has been stolen." A writer upon this subject has said that "defective drainage may render that which was intended to be an abode of peace, plenty, and happiness a living charnel-house or the door to the grave." Defective sanitary arrangements are in no way confined to the dwellings of the poorer classes, but are to be met with in the palatial residences of the aristocracy.

Doubtless all present will remember the panic that spread throughout the length and breadth of the land some ten years ago, when H.R.H. the Prince of Wales was stricken with typhoid fever, how anxiously we all scanned the morning papers giving an account of the progress made by the royal patient, and how the whole empire as one man rejoiced at his recovery.

There is no doubt that a large amount of good resulted from this attack; it roused people to a sense of their danger, and caused them

to look into their sanitary surroundings, and correct any defects that might be found.

We are told that, fifty years ago, medicine proceeded entirely upon the curative theory, that the practitioner but rarely bothered himself with questions of water-supply or drainage; he sought to effect a cure, and would then leave the surroundings of the patient in much the same state as he found them. Happily this state of things does not now exist, for since the Health of Towns Commission began its labours some forty-five years ago, wonderful strides have been made with sanitary science; it has demonstrated the fact that all diseases have definite causes, some acting through one agent and some another. Medical men now agree that "sanitary law" is the preventive medicine, by the aid of which they are enabled to strike at the root of the evil; but to do this properly they require to have the assistance of local authorities, plumbers, and builders, who are to a great extent the most important agencies in matters of health and disease.

By the Public Health Act of 1875, considerable powers are given to, and no less responsibilities thrown upon, sanitary inspectors who are often called upon to undertake responsibilities far in excess of what is justified by their opportunities to protect themselves. They have not only to contend against the cunning of some workmen, but to guard against the "jerry builder," a man who is often as innocent of the art of building construction as he is of the elements of common honesty. A description of this complex individual is unnecessary; he is known to almost every sanitary officer, and but few districts are blessed by his absence. To this class we may surely apply the Hindoo proverb, "He whom God has given up to error, him wilt thou in vain try to enlighten." To carry out a thorough system of building inspection would require an increase of the official staff, which means an increase to the local rates, the very sound of which weighs against many much-needed sanitary reforms.

It would be a great improvement if local authorities would undertake the laying of all house drains, just as they lay the town sewers, charging the cost to the owners, for it appears to be a waste of public money to provide good and efficient sewers, unless the house-drains be properly constructed.

We have long had compulsory registration, compulsory vaccination, and compulsory education, but it is much to be regretted that we have not yet reached a perfect system of compulsory sanitation. A reference to the official tables of death-rates will show the serious

proportion of deaths occurring annually through preventible diseases traceable to defective sanitary arrangements in or about our houses. The deaths in England and Wales from seven principal zymotic diseases, for the year ending June 30th, 1881, reached 74,062. These deaths were preventible but not prevented.

One of the best safeguards against the spread of infectious diseases is a pure atmosphere within the dwellings, and this can only be accomplished by paying great attention to the sanitary surroundings, proper construction and connections of drains, &c. The numerous defects by which the deadly enemy to health, sewer gas, is allowed to escape from the drains and poison the internal air of our houses are so well known, that the author considers it unnecessary to mention them, he therefore proposes referring to only a few of the most important points in reference to house sanitation, which are as under:—

1st. When it can possibly be avoided, drains should not be laid underneath houses; but if it cannot be avoided, the greatest care should be exercised in having the pipes well laid on solid foundations, and having air-tight joints. To ensure this they should have a covering 3 or 4 inches thick of cement concrete.

2nd. The house drains should be properly trapped from the sewers, and there should not be the least direct connection between the sewer and the bath, sink, lavatories, soil pipe, or overflow from cistern, all of which should discharge outside the house. The question of inside or outside soil pipes is one that has been fully discussed, and no doubt each system has its advantages. The author is an advocate of the outside system, contending that the water-closet should be placed as near as possible to an external wall.

3rd. The soil pipe should not be less than 4 inches internal diameter. If made of cast-iron, the joints should be made perfectly tight, and the pipe should be carried (full bore) up above the eaves, but not too near any window or chimney. The soil pipes should never be used for the purpose of conveying rain water, because this destroys the upward current at a time when it is most needed.

Dr. Letheby found that sewage gave off from 1 to $1\frac{1}{2}$ cubic feet of gas per hour per gallon, composed of light carburetted hydrogen, carbonic acid, sulphuretted hydrogen alone and with ammonia, and with these there was mingled a putrid organic vapour. From a number of experiments made by Dr. Fergus, of Glasgow, it was

found that these gases would, under certain conditions, pass through the trapping water of a trap, being absorbed on one side and given off on the other; it therefore becomes necessary to provide some means of ventilation and disconnection between the house drain and the water trap leading to the town sewer. Many systems have been arranged and carried out by different authorities, and have all proved more or less satisfactory. Amongst those may be mentioned the names of Rogers Field, Dr. Woodhead, Norman Shaw, and others.

It is not the wish of the author to condemn a system upon which no doubt much might be said, but he cannot help expressing an opinion that the somewhat high cost and complicated character of that designed by Dr. Woodhead must debar its general adoption; any sanitary appliances which do not possess the elements of simplicity must fail because they do not supply the wants of the public. In the opinion of the author, their wants would be fully supplied by the adoption of the scheme shown in the sketch of Stiff's "Registered Interceptor Sewer Air Trap." The sewer gas is intercepted by means of two dips, A and B, between which a means of ventilation is provided, which should be carried to the level of the yard. Generally the gas will be confined to the chamber C but should there be sufficient pressure to force the trap at A, the gas will enter the chamber D, and at once escape through the ventilator E. The second trap B, having a dip of about 7 inches, will prevent any foul gases reaching the chamber F. The trap is so arranged that the sewage is discharged directly into the chamber C through a cone or funnel-shaped bent pipe, similar to the one used by Dr. Woodhead, which should be added to the trap. G is a pipe by means of which the trap can be cleaned out when needed; this must be carefully closed at the top, or it will act as a ventilator for the town sewer. The arrangement is such that there will be a constant current of fresh air passing up the soil pipe, caused by the column of fresh air pressing upon the opening H, the area of which is considerably larger than the soil pipe or the opening I, through which any foul air given off by the trapping water will escape, and as Mr. Rawlinson, C.B., says in a letter to the *Times* of December 6th, 1872: "The philosophy of the question of good drainage seems to be, that stinks in the open air do a minimum of injury, but that gases of decomposition within rooms, and in stagnant air, become dangerous to health." The author is convinced that where a fair trial is given to the arrange-

ment as laid down, there will be but little danger of sewer gas entering the dwelling. We shall then be able, as a writer has said, to call our place of abode "Home, sweet home."

It is not given to all men to know all things. It is therefore the wish of the writer that the views and opinions herein contained should be as fully and as freely discussed as time will permit; for it is only by the pleasurable interchange of thought, and by the experience of others that we obtain new views of old ideas. The only desire of the author is to see houses made wholesome, which are now little better than fever traps, and generally to see the sanitary condition of domestic dwellings improved, for which there is ample room.

DISCUSSION.

The CHAIRMAN proposed that the discussion on the three papers be taken together; this was duly seconded, and carried unanimously.

The CHAIRMAN: We have now heard the three papers, and I expect an interesting discussion will ensue. The first paper, Mr. Hall's, is connected with the district in which we now are, and displays a new phase in the disposal of sewage. We will discuss it first, and then proceed to the other two. I notice that no mention is made of chemicals. In Leeds, where such a scheme is in operation, chemicals were used to precipitate the solid matter, but I am given to understand that for some time past liquid lime only has been applied.

Mr. HALL: We intend to drain into the Tees. All the conservators ask is that we clarify the sewage. We do not remove the noxious matter. It has been discovered that the sewage carried out by the tide forms a bank.

The CHAIRMAN: It is the same wherever a large town drains into a tidal river.

Mr. McKIE: How long will it take the water to settle?

Mr. HALL: That is uncertain.

Mr. McKIE: I am afraid you will find more solid matter in the river bottom than in the tanks. What proportion will be removed remains to be seen.

Mr. SPENCER: Before Mr. Hall's advent here, I laid out some fifty acres of building land, but only about half that area has been available on account of the drainage. Had Mr. Hall's scheme been

put into force then, the whole of that land would have been sold. With regard to Mr. Hall's scheme, though it is not filtration, it will be sufficient for Stockton, situated as it is on a tidal river. Mr. Hall, in his paper, does not enter into details as to the working of the system. I should like to know what he proposes to do with the solid matter deposited in the tanks. The scheme, I understand, embraces six acres of land, but it is not proposed to utilise the whole unless necessary. As to the outlet, I wish to know if it is tide-locked. I should also like to know if the scheme is applicable to the whole of the borough, though I suppose it is not, being restricted to that portion now draining into Lustrum Beck. I shall be glad if Mr. Hall will give some idea of the probable cost. I should also like him to say whether there is a special means of forcing the sewage through the syphons without leaving sediment.

MR. STAINTHORPE: How often will the tanks require cleaning out, and what will be the cost?

MR. HALL, in reply, said: The water from the settling tanks will be much clearer than the fresh water forced up in the river. The scheme does not go to the borough boundary, but I have a scheme which will embrace the whole of the borough, with the exception of the low-lying portion near the river. By extending the scheme, all other outlets will be intercepted. With regard to the solid matter, if it cannot be sold, we will have to dig it in. The outlet will be tide-locked. The work has not yet been commenced. The Government inspector has given his consent, but the formal sanction has not yet been received. As to the cleaning out of the tanks, it will require three men, and the cost will be something like 150*l.* a year. The tanks will be cleaned out when necessary; at present it is expected that the tanks will require to be cleaned out once a month. The cost of the works will be covered by a 1½*d.* rate on the present rateable value. But the rateable value is increasing, and should the present prosperity continue, we expect that a penny rate, or even less, will do.

MR. STAINTHORPE: How about the cleaning of the syphons?

MR. HALL: We will flush them. We have arranged for that. There is a valve to stop the sewage.

MR. SPENCER then said: It is my pleasing duty to propose a hearty vote of thanks to Mr. Hall. The chairman thinks that each writer should have a separate vote of thanks, and I cordially agree with him. The ability displayed by each author certainly deserves that honour. I have therefore very great pleasure in proposing

a vote of thanks to Mr. Hall for his very interesting paper, and for his drawings, which form a not unimportant adjunct.

Mr. DOWNIE: Would it not have been better if the paper had been printed? I think it would have been a great advantage had the Members had the paper in their hands before the meeting.

The CHAIRMAN: You can bring forward a motion with regard to future papers.

Mr. HAWDON: I have great pleasure in seconding the vote of thanks to Mr. Hall.

The CHAIRMAN, in putting the vote of thanks to the meeting, said: In Stockton, as elsewhere, if they would precipitate the solid matter, they must use chemicals. The sediment will have to be dug out of the tanks. This will have to be done once a fortnight or after a storm. It had been found so at Leeds and Birmingham. I think Mr. Hall is on the right track for economy.

Mr. HALL: We can use chemicals to precipitate the solid matter if necessary.

The CHAIRMAN then put the motion to the vote, and it was carried by acclamation.

The HON. DISTRICT SECRETARY: As to the printing of the papers, I am afraid it would entail considerable expense if the papers are to be sent to all Members of the Association as proposed, it would raise the subscriptions considerably. But copies could be sent to each Member notifying his intention of being present at the meeting at which they were to be read, providing he gave three days' notice to that effect.

Mr. DOWNIE: I will move a resolution on the subject.

The CHAIRMAN: I understood that all papers had to be printed in pamphlet form. It will be waste to have them printed twice over.

The HON. DISTRICT SECRETARY: Mr. Downie wishes the papers to be in the hands of the Members prior to the meetings.

The CHAIRMAN: There is no great difficulty in that. They can be printed before the meetings as easily as afterwards.

Mr. JAMES HALL: I cannot see how that can be.

The CHAIRMAN: The papers have to be printed at the expense of the Association. There can be no harm in having them printed in the form they have to assume, and copies forwarded to the Members by post.

Mr. JAMES HALL: As the expenses of these meetings are not defrayed by the parent Association, would it not be as well to have

a fund, raised by subscriptions, say of 2s. 6d. per annum, to defray the cost of printing the papers. I do not know whether this is in accordance with rule, but I think it worth consideration.

Mr. M. HALL: I think this is out of order.

The CHAIRMAN: We will now proceed to the discussion of Mr. McKie's paper. I do not purpose saying anything myself at present, further than to indicate some of the points on which discussion will be profitable. There is the question of inspectors; the question of sanitary pipes: lead pipes, iron pipes; water-closets. All these will supply ample material for discussion.

Mr. SPENCER: I am almost ashamed to monopolise any more of your time, but in order to set the ball a-rolling, I will begin the discussion. There is nothing at all in Mr. McKie's paper that is out of place. It is practical and historical, and ought to have been first read either at Birmingham or London. I am sorry that some of our older, or rather more experienced, Members are not present, as the paper deserves the attention of all. Mr. McKie touches lightly on historical matters, referring to the old barons' castles, and the old ready mode of disposing of sewage. To my mind it is a question whether we are much better off in this respect. We pass the sewage down rivers to the annoyance of others; the old barons kept it in the moats to themselves. It would seem, in some respects, that the old barons' plan was the better of the two. A matter which came under my notice while travelling in Ireland curiously illustrates this part of Mr. McKie's paper, and endorses in a remarkable manner his remarks on the old method of disposing of sewage. I had occasion to stay at an old family mansion in county Monaghan, and was struck with the want of modern sanitary appliances. In the dressing-room adjoining the bedroom I occupied, was an old cabinet, and from it went a shaft, to where I cannot tell. It had an unknown outlet. I found out that all the bedrooms were supplied with these shafts or flues, but where they led to I was unable to discover. They were the only substitutes for water-closets, and were used as such. I believe every word in condemnation of the trough system to be true, for I do not know of a more horrible system than that just condemned. Then, as to the private drains, there ought to be some compulsion to enforce the putting in of private drains under the direction of properly qualified sanitary engineers. I cannot find anything to disagree with in the remarks about water traps; I also agree with the remarks on having good jointed pipes for drains under houses. I hope Mr. McKie will see

his way clear to revise and add to his paper, and have it printed, as I think it a most important one.

Mr. BELL: It is indeed a splendid paper, and I am only sorry that there are not more of the Members present. It is full of suggestions, and worthy of being studied by old and young.

The CHAIRMAN: I thoroughly agree with Mr. McKie with regard to the putting in of house drains. In Manchester, technically educated men only are allowed to put in house drains. I am thoroughly in favour of having certified men for such work, and would not allow any man to break open the street for such a purpose unless he was properly qualified. With regard to the trough closets, there are trough closets and trough closets. Those at Leeds are of a superior kind. They have a cistern at one end, are self-acting, and consequently are flushed out regularly. I believe that iron pipes are best for houses. They may not look so well as lead, but they are much more wholesome; of course it is of great importance that iron pipes should be coated, as a 2-inch iron pipe coated with asphalte will discharge more water than if uncoated.

The HON. DISTRICT SECRETARY moved, and Mr. BELL seconded, a vote of thanks to Mr. McKie, and it was carried by acclamation.

Mr. McKie, in reply, said: I thank you all for your very kind and flattering remarks. It is our province to make the world sanitarily better than we found it, and I shall be glad indeed if I have contributed in any way, however small, to that end. We want a more perfect sanitary pipe; what that pipe will be I do not know, but as we go on with these meetings, and get more meetings, continually discussing the matter, the object will in the end be attained. The fittest will survive, but it is only by discussion that we can know which is the fittest; therefore I hope the matter will be kept before the Members. The plans produced to illustrate the paper are tracings of my own working drawings, and also those of my friends, which give you the present practice of three different engineers, in Germany, in London, and in the north of England.

The CHAIRMAN, in drawing attention to the next paper, said: I am glad to find Mr. Thorrold advocating good sanitary arrangements for the poor as well as the rich. There are several points in the paper worthy of discussion.

Mr. McKie: Of what material would you make the soil pipes?

Mr. THORROLD: Of cast iron.

Mr. McKIE: I have made soil pipes of the best lap-weld screw-jointed galvanised wrought iron, but I am not satisfied, and want to find something better.

The CHAIRMAN: They might do for water supply, but I would not recommend them for sewage outlets.

Mr. PICKERING: I think galvanised iron useless.

Mr. JAMES HALL: I think water-closets should always be separate from the houses. I never advocate them, but in some quarters they are regarded almost as a necessity. We use cast-iron pipes here, and with some solution they do very well, but they will not do for down-corners.

Mr. SPENCER: I quite endorse what has been said about compulsory sanitation, and think the pressure should come from the Legislature. You may talk about centralisation, but it is a fact that there is more enlightenment on sanitary matters in the metropolis—not in the vestries, bear in mind—than in municipal bodies. Most of you will agree in this, that we must look to Parliament to put us right, so that corporations and local boards may be compelled to do their very best for their districts, whether they are out of pocket or not. Water-closets in houses are condemned by some, yet they are regarded as necessities by others. I have no decided opinion as to which kind of water-closet is the best, but one which I have seen in use, made by Beck and Co., London, is really good. Whether soil pipes should be fixed outside or inside the house, is a vexed question, but I think in the event of an accident to the pipe, outside is the best. With regard to the material, iron will not stand the ordinary atmosphere, let alone sewage; hence some solution must be applied.

The CHAIRMAN: I am glad the author of this paper considered the comfort and convenience of the working classes. It is the will of the All-wise Ruling Power that if we do not look to their comfort, we ourselves must suffer. I believe that every artisan's cottage should be as perfect in sanitary arrangements as the villa of the rich man. In designing a house, the sanitary arrangements should be first considered, not last, as is too often the case. With regard to soil pipes, no down pipe should be less than 6 inches in diameter where it reaches the ground. Valve closets are all very well when in perfect order, but the least thing puts them wrong. The most simple closets were those at Leeds and elsewhere. They had clean water constantly in the pan, and a foot from that a ventilator, so that no gas could rise.

Mr. M. HALL moved, and Mr. PICKERING seconded, a vote of thanks to Mr. Thorrold, which, on being put, was carried by acclamation.

Mr. THORROLD replied, thanking the Members for their vote of thanks.

Mr. DOWNIE then moved his resolution as follows :—" That the Secretary of the Northern District meeting of this Association be authorised to have the papers of intending essayists placed in the hands of the Members (Northern District especially) three days at least prior to the meeting."

This was duly seconded, and carried unanimously.

The CHAIRMAN : There is yet another matter to consider. Where shall the next meeting be held? I may say that York has been mentioned.

Mr. JAMES HALL : I move that the next meeting be held at York.

Mr. PICKERING seconded the motion.

Carried unanimously.

Mr. THORROLD : I have very great pleasure in moving a vote of thanks to the Chairman. He has fulfilled the duties in a courteous and able manner, and to the satisfaction of all.

Mr. M. Hall seconded the motion, and it was carried by acclamation.

The CHAIRMAN having briefly replied,

The HON. DISTRICT SECRETARY moved a vote of thanks to the Town Council for the use of the Council Chamber.

Mr. McKIE seconded the motion, and it was carried by acclamation.

Alderman DODDS replied, assuring the Members that they would be ever welcome to Stockton.

The proceedings then terminated.

The Members afterwards dined together at the Black Lion Hotel, High Street.

DISTRICT MEETING AT YORK,

February 24, 1882,

Held in the Council Chamber at the Guildhall, York,

Mr. LEWIS ANGELL, *Past President, in the Chair.*

THE Members having assembled, the minutes of the last meeting were confirmed, after which Mr. Benjamin C. Cross was unanimously re-elected Honorary Secretary for the Yorkshire District.

The following papers were then read and discussed : —

YORK, AND ITS PUBLIC WORKS.

By G. STYAN, CITY SURVEYOR, YORK.

In the following brief sketch of the principal undertakings which have within a recent period been undertaken by the Corporation of the old city of York, no great amount of interest or additional knowledge will be imparted to those now assembled, most if not all of whom have doubtless been concerned, both professionally and officially, in carrying out or inspecting from time to time works of far greater importance and magnitude than those which the city of York can at the present time boast of. Not that York is deficient of enterprise, or not rich in works of bygone ages from which much may be learned in the matter of architectural and kindred subjects; as witness, on the one hand, its splendid Railway Station and Hotel, its Fine Art and Industrial Exhibition, both of recent erection, its Festival, Concert, and Assembly Rooms, and, on the other hand, its noble Cathedral, its Old Walls and Towers, and its Abbey ruins. But, as is well known, York is not a manufacturing town, and therefore we look in vain for those great works of a public or private character which almost every large town has, either by its Corporation or by its wealthy merchants, undertaken within a recent period of time.

Small and ill-constructed municipal buildings have given place to the spacious and magnificent town halls of the present day; wide and spacious streets are required on every hand.

Sanitary science has called for works of sewerage, ventilation, and manipulation of house and other refuse never dreamt of in former times, whilst extensive and costly buildings and domains are everywhere taking the place of small and inconvenient warehouses and dwellings.

York is, however, slow to follow this stream of enterprise, although within the past few years greater progress has been made in effecting improvements than was done in former years. Hence no great works can be pointed to at the present time.

However, the following remarks upon such works as have been undertaken by the city may perhaps possess some degree of interest to those now present.

The first subject in order of date is the sewerage of the city, which was undertaken in the years 1854 and 1855. Prior to the new sewers being constructed, the city was drained by comparatively small brick drains, common bricks and mortar being principally used in their build, and laid at no very great depth. These drains discharged into the rivers Ouse and Foss. When the new sewers were constructed, they were made of a much larger diameter, laid at a greater depth, and all made to discharge into the Ouse only. They were built of radiating bricks, and lias lime was used instead of common mortar. They were undertaken in "Sections or Districts" as follows :—

The Mount District sewer commenced at Clementhorpe and terminated in Holgate Lane, a distance of 1733 yards. This sewer drains the south side of the city. It is egg-shaped, 48 inches by 32 inches internal diameter, and varying from 14 feet to 28 feet in depth, and discharges into the Ouse at Clementhorpe nearly opposite to Blue Bridge, a short distance outside the city.

The Goodramgate District sewer was commenced on the 22nd May, 1854, at Waterloo Buildings, near to Ouse Bridge (where it empties), and terminates at Monk Bar, a distance of 730 yards. It is egg shaped, and 48 inches by 32 inches for nearly half its distance, formed with a double rim of brickwork, each $4\frac{1}{4}$ inches, laid in lias lime. The remainder of the sewer is 36 inches by 28 inches, also egg shaped, and formed with one rim of brickwork 6 inches thick. During the construction of this sewer, quicksands were discovered on the line of drainage, but these difficulties were met by using flags

for a foundation upon which the sewer was laid. This sewer drains what may be regarded as the "central" part of the city.

In order to prevent the Groves, Heworth Moor, and Layerthorpe sewers from discharging into the Foss, which polluted that stream to a very serious extent, intercepting sewers were constructed on each side of the river from a point near Monk Bridge to Piccadilly, where they joined the main sewer, which is 950 yards in length, and 4 feet 6 inches diameter, and through it discharge into the Ouse near to Blue Bridge. These intercepting sewers vary in size from 30 inches to 24 inches, are built in bricks and lias lime, and together are 3300 yards in length. The cost of executing the several sewers above referred to amounted to upwards of 15,000*l*.

Since 1855, various sections of the city have had new sewers constructed as occasion demanded, and such parts of the city as were sufficiently drained by the then existing sewers were not, of course, disturbed, and they still exist. But these may, and doubtless will, eventually have to give place to new and larger sewers.

The total length of the sewers now under the care of the Corporation is about twenty-six miles.

No system of ventilating or flushing any of the city sewers has as yet been adopted, but it is in my opinion highly desirable that both these requisites should form and be a necessary feature in connection with sewerage arrangement. The cost will no doubt be considerable, varying of course with the circumstances of each town, but grave questions of health are involved, and these should have primary consideration at the hands of local authorities.

Into the question of what is the best means of ventilation, whether the open grate, furnace, or shaft system, the author will not here enter, each system possessing merits of its own, and each having its advocates.

In connection with the sewerage question, the author may mention that the privy and ash-pit system forms a part of the house arrangements of the city, although very many w.c.'s have been and are still being provided, not only voluntarily by builders themselves, but by order of the Urban Sanitary Authority, who direct the abolition of privies when they consider it advisable or necessary to do so. There is no system of night-soil collection by the Sanitary Authority, although the scavengers of the Board do go round a small portion of the city on certain mornings collecting ashes from householders who have no pits on their premises. Otherwise the

inhabitants themselves arrange for the cleansing of their ash-pits, &c.

The next subject is that of the York Cattle Market. This market is situate near to Walmgate Bar, immediately outside the walls of the city, and in 1855 was reconstructed and enlarged. Its area is six acres, and it is fitted up into pens, which are constructed of iron, with floors of Portland cement concrete. Accommodation is provided for 18,000 sheep (although as many as 24,000 have been known to be brought at one market) and 3576 head of cattle.

In connection with the market, spacious covered and lock-up sheds have been provided for the wool market, which used formerly to be held in an open street called Peasholme Green. The total cost of reconstructing the market as it now stands has been about 17,500*l*.

In the year 1862, a new bridge was erected over the River Ouse at Lendal, in lieu of the then existing ferry. This bridge, mediæval in its style of architecture, &c., is in direct communication with the railway station. It is of one span, 175 feet 6 inches in width, and constructed of iron, the designer being the late Mr. Thomas Page, C.E. Its cost, including approaches, &c., was nearly 40,000*l*.

In connection with the erection of this bridge, Museum Street and Duncombe Place were widened and improved as they now appear, from narrow and inconvenient thoroughfares, thereby effecting not only a great street improvement, but also opening out and exposing in bold relief the west end of the grand old cathedral.

In 1874, the Corporation erected bonding warehouses for the accommodation of the traders of the city. They are situated in Skeldergate near to the new Skeldergate Bridge, and cost about 3200*l*. They are three storeys in height, and have a floor area of 9500 square feet. They are largely used, and give great satisfaction to the traders.

In consequence of a necessity for increased accommodation for the various scavenging and other departments of the Sanitary Authority, new stables (for fifteen horses), sheds, store yards, offices and dwellings for the clerk of the works and foreman of scavengers, were constructed, in 1875, on Foss Islands, at a cost of 3000*l*.

A new bridge over the Ouse at Skeldergate Ferry was completed in 1880 (opened 1st January, 1881), at a net cost of about 50,000*l*. The bridge is constructed of wrought and cast iron, and spans the river by three arches, viz. centre arch, 90 feet wide

and two side arches, each 30 feet wide; there are also two land arches of 20 feet each. One of the 30 feet arches is constructed to open, by means of hydraulic machinery, to allow of vessels with fixed masts passing up the river. The piers, abutments, and approach walls are executed in stone, brick, and concrete, which materials were taken from the old and disused jail near to the bridge. The width of the bridge is 40 feet. Its style of architecture is Gothic or mediæval, the designer being Mr. J. G. Page, C.E., of London. The contractors for the ironwork were Messrs. Handyside and Co., of Derby; Messrs. Armstrong and Co., of Newcastle, supplying the hydraulic machinery, and the Corporation, under my own supervision, constructing the whole of the masonry, brickwork, and approaches.

Public baths were opened in 1880. They are situate in St. George's Field, near to the Skeldergate Bridge, and consist of two swimming-baths, each 70 feet long by 25 feet in width, varying in depth from 6 feet to 3 feet, with fifteen slipper-baths; also boiler-house, wash-house, and other conveniences. The floors of the swimming-baths are covered with white glazed tiles, and the sides built of white glazed bricks.

The supply of water is obtained by gravitation from the river Foss, the water passing through a filter-bed before being used in the baths. There are no distinguishing features in connection with the baths or their construction which call for special remark. The style of architecture which the author adopted for the buildings was Italian. The cost was upwards of 6000*l*.

A Fever Hospital was also completed in 1880. It is situated on the Huntington road, about one mile from the city, and was designed by me in consultation with the Medical Officer of Health. The style is Italian. The building consists of two blocks, a central block and one block to the west connected with the central block by a covered way, they are of red bricks and stone dressings. The administrative department includes rooms for the care-taker and for other purposes, there being two sitting-rooms, kitchen, scullery, store-room, larder and other closets. On the first floor are four spacious bedrooms. In the block for patients, two wards, each containing six beds, and two day-rooms are provided. They are well lighted from windows on each side, and the walls are plastered with Parian cement. The floors are of pitch pine. The size of the wards gives 2000 cubic feet of air space to each patient with a floor space of 144 feet to each. Although the building is

limited in its accommodation for patients, yet provision is made whereby temporary additions can immediately be provided for an outbreak of fever in the city. The hospital is intended for the citizens above the pauper class, for whom accommodation is provided in connection with the workhouse.

The Theatre Royal in St. Leonard's Place has just been improved by the addition of a stone front to the building after a design prepared by the author, who adopted the Gothic style for this front. In addition to the improved appearance of the building, additional accommodation is provided for use in connection with the theatre. The cost of the improvement has been upwards of 3000*l*.

A new street improvement is now being carried out in Castle-gate, so as to provide a better approach into the city from the south-eastern portion of the city and suburbs. A large number of small and dilapidated houses have been demolished and cleared away, and what was once a very unhealthy area will give place to wide and spacious streets and new and better houses and buildings. The cost of this improvement will be about 25,000*l*.

A large warehouse adjoining the bonding warehouses is in course of erection, for the landing and storing of goods brought up the river Ouse. It is four storeys in height constructed on fire-proof principles, and provided with steam cranes for loading and unloading goods from vessels. The floor space is 10,000 square feet. The cost will be upwards of 3000*l*.

The above are the principal works which the Corporation have recently undertaken, and although in some respects they probably possess no features of special interest to the Members of the Association, yet all these works have been undertaken in a practical way to meet necessities which have from time to time arisen in the city.

DISCUSSION.

A discussion, which took a conversational form, followed the reading of the paper. A number of questions were put to Mr. Styan by gentlemen present. Replying to the Chairman, he stated that the sewage flows into the river Ouse below the city. No sewers enter the river Foss. The greatest length of sewer unventilated from the outfall to the summit of any system was, he believed, about 3000 yards. Some sewers were trapped,

others were not. Street and yard grates were connected with the drains. They had a fair number of water-closets in York, but the privy system was most general. The privies did not drain into the sewers. The population of York was nearly 50,000. Being asked whether it was left optional with builders whether they provide water-closets or not, Mr. Styan said it depended upon the situation. If there was plenty of room, the Corporation did not object to privies properly constructed. The Corporation removed the night-soil if they were applied to, and they charged according to the actual time the men were employed. In the Hospital for Infectious Diseases there were two wards, with six beds in each. The plan of the building provided for double that number, the plan having only been partly carried out; 2000 cubic feet per patient for each bed were allowed, and 144 superficial feet of space. As to the water-closets of York, Mr. Styan said water was supplied to consumers by a private company who owned the waterworks. The company had a scale of charges for the water used in the closets, and for other purposes. Regarding the cleansing of the ash-pits, he did not know that the Corporation had any special Act by which they charged for cleansing them when tenants requested them to do so.

Mr. J. HALL: I understand that by the Public Health Act it is incumbent on towns to cleanse their ash-pits.

Mr. STYAN: So soon as we levied a rate for the cleansing of ash-pits, we ceased to have power to make a charge for that purpose.

The CHAIRMAN: The Public Health Act makes it obligatory on a local authority to effect all the scavenging work of a district, and on complaint the authority can be compelled to do the work.

Mr. SCRIVEN: Are there no bye-laws for the city of York in compliance with the Public Health Act, 1875, with regard to cleansing of ash-pits and the like?

Mr. STYAN: We have bye-laws for new buildings, scavenging, &c.

Mr. HALL: How do you dispose of the contents of ash-pits?

Mr. STYAN: It is disposed of and used upon the land. The houses drain into the sewers. Ash-pit refuse is mixed with street sweepings and then sold to farmers. It has generally been sold at 3s. 2d. per cubic yard from the pit heap, which is just outside the city. A person having a water-closet would pay for the water used therein, and would therefore pay for the removal of the excreta through the water rent. The Corporation of York has no rate which enables them to remove the ash-pit refuse.

Mr. HEWSON: Is the Fever Hospital a permanent building? and what was its cost?

Mr. STYAN: It is a permanent building, and its cost, including the land, was about 5000*l*. The present building could accommodate sixteen beds.

Mr. HEWSON: I am astonished at the price; 300*l*. per bed is something frightful.

Mr. STYAN: The administrative buildings are included in the above figure. There have not been many cases of infectious disease in York, and the principal cases are scarlet fever. The death-rate for the past year in York is 19 per 1000.

Mr. HEWSON: Is there any difficulty in removing scarlet-fever patients?

Mr. STYAN: In some cases they are not willing to go.

Mr. HEWSON: During the past week or two I have had the work of erecting a temporary hospital for small-pox cases. Adopting the Government plan for about sixteen to eighteen patients, I got a tender for the erection of a wooden building, which was to be covered with corrugated iron outside and have separate wards for the sexes, &c., &c. The amount was 630*l*. We hope that the epidemic will subside before it is completed.

The CHAIRMAN: Can any one who wishes have his water-closet connected with the sewer; is there any prohibition?

Mr. STYAN: No. One side of the city is upon gravel sub-soil, and the other on clay. The ash-pits principally are on the gravel formation. In some parts the outfall is subject to backing-up by the water in the river.

The CHAIRMAN: In some parts during the year you will be entirely blocked up?

Mr. STYAN: No doubt.

Mr. W. G. PENTY: In York nine-tenths of the ash-pits are emptied by private enterprise, and a very small proportion is emptied by the Corporation. I think there is much need for a covered market at York, for the want of which business has been driven to other places.

The CHAIRMAN said they would all feel indebted to Mr. Styan for the description he had given of the various works in York. It so happened that exactly thirty years ago he was in York, where he lived some two years, before the time of the great exhibition. Until last (Thursday) night he had never returned. During the short time he had been in York he had already seen considerable

improvements on the former period, and indeed they had heard from Mr. Styan that these had been carried out at the cost of several thousands of pounds. York, therefore, had not been altogether idle. They had had an interesting conversation that day, and, being guests of the Corporation, they did not wish to criticise too much what had been or had not been done in York. There were some things of course which surprised them; but the interchange of ideas between them that day had afforded some information. He must say that he had been surprised to find a system of drainage by which the sewage from both sides of the city was discharged into the river. This was indeed a contravention of the Rivers Pollution Act. It was also a matter of surprise to find that twenty-six miles of sewers were not ventilated. York had the reputation of being a very quiet place. It had not in it that go-ahead mercantile energy found in Leeds and many other large places, of course every district knew its own wants and necessities best, and by some it was not deemed necessary to put certain bye-laws in force, and thereby incur additional obligations. It was satisfactory to find from what Mr. Styan had stated that the death-rate for the year was so low. He invited those present to tender their thanks to Mr. Styan for his trouble in arranging for the meeting, and for his description of the public works of York.

DWELLINGS FOR THE LABOURING CLASS IN OUR LARGE TOWNS.

BY E. R. S. ESCOTT, BOROUGH ENGINEER, HALIFAX.

THE subject of this paper has of late years occupied the time and attention of our worthy representatives at Westminster, and also of every thoughtful man, or employer of labour, who considers for a moment the welfare and comfort of the human race, beyond getting as much out of them as it is possible to obtain during the nine or ten working hours of the day, and caring nothing for their happiness for the remaining fourteen hours out of the twenty-four.

The application of the subject must necessarily be a very wide one, and also very varied, for what is tolerated in London, Liverpool, Manchester, or such towns, is neither called for, nor desirable for adoption, in the provincial towns throughout this great empire.

The great bulk of our population is made up of the labouring class; and to provide comfortable and suitable dwellings, in a sanitary point of view, must be of no little importance to the municipal and sanitary engineer, and the subject is almost daily coming under his notice, not only as an employer of labour, but as one whose duty it is, to the best of his ability, to carry out the sanitary regulations laid down by Parliament, comprised in many local Acts, in addition to the Public Health Act of 1875.

In many large towns the "flat" system has been extensively adopted, and very fine and expensive buildings erected, with all modern sanitary improvements.

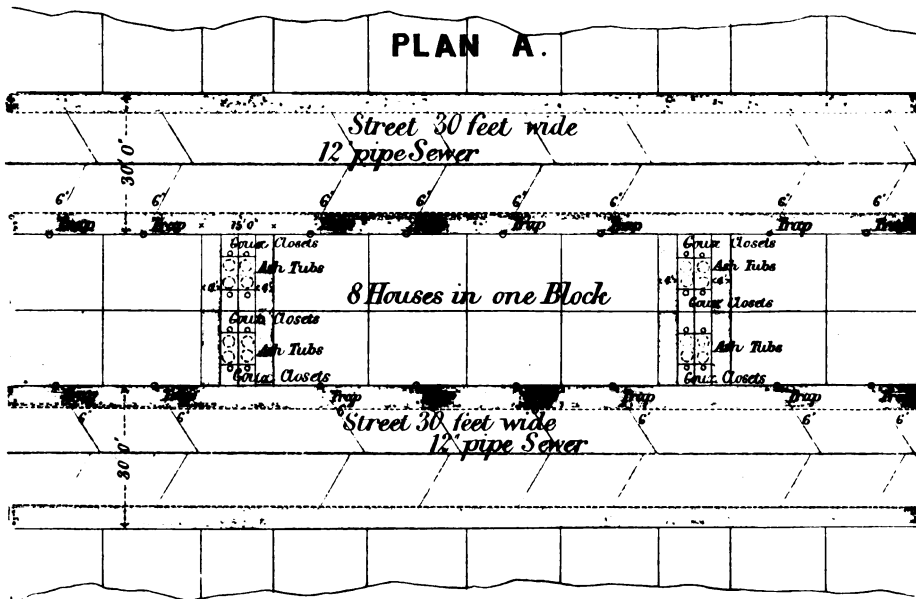
Again, there is found the "through" house, with garden in front and yard behind; but the author believes that the north stands alone in its adoption of what is known as the "back-to-back" system.

It is generally observed that where any town advances in importance and population, and new streets are laid out and houses built, the wealthier class of people forsake the dwellings situated in the narrow thoroughfares of the old portion of the town for the fresh air and sunshine of the west end, leaving others to occupy the old mansions and family houses, no longer to be enjoyed by one tenant; but, in order to obtain a reasonable rent for the property,

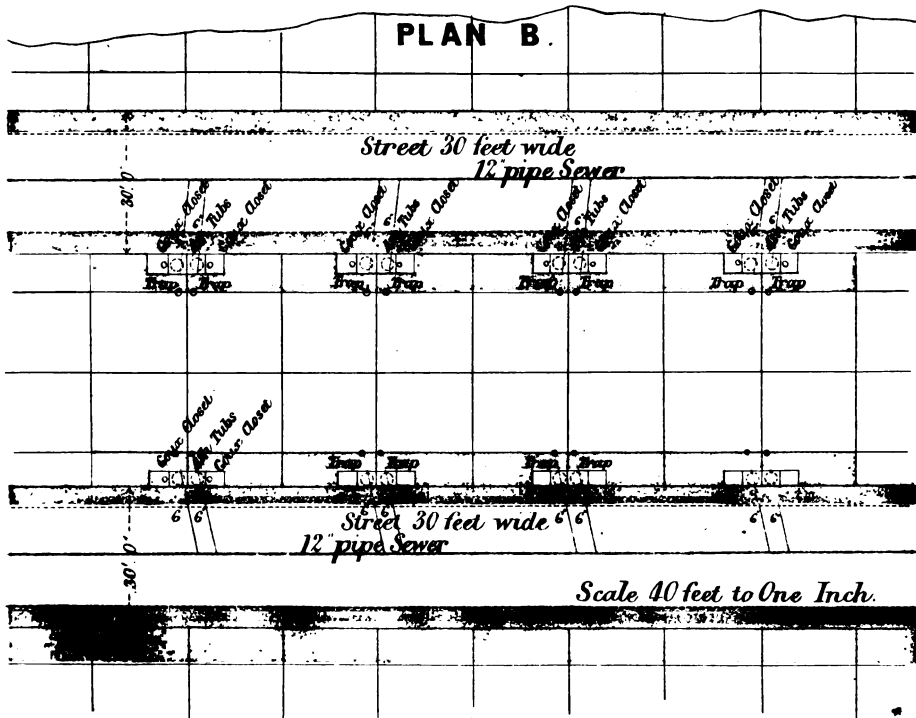
DWELLINGS FOR THE LABOURING CLASS IN OUR LARGE TOWNS.

E. R. S. Escott.

PLAN A.



PLAN B.





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the same are divided and sub-divided into as many dwellings as will suit the requirements of the time.

This is certainly the most objectionable class of dwelling with which the sanitary engineer is called upon to deal. The rooms are often small and low, ventilation insufficient, the privy and ash-pit accommodation, which was more than ample for one family, by no means adequate for half-a-dozen. It may be said that such places should not be allowed, that Acts of Parliament give many and great powers; true, all this is granted, but where is the town of any importance that has not its "Petticoat Lane," its hells, and its fever dens of infamy, and most heartily should he be congratulated who has, even in a small degree, been the instrument in banishing such abodes from the face of the earth.

Whether we claim to be the authors of the "flat system," or grant it to our Scotch friends over the Border, need not be discussed in this paper, the system has for many years been extensively adopted, and many towns can point with no little pride to what has been done in order to "elevate" the labouring class into comfortable houses.

This plan would certainly suggest itself to the architect in designing cottages on ground of great value, the superficial area being limited, but the vertical height inexhaustible; and no doubt where the design is properly considered, comprising all the latest sanitary requirements, and the buildings erected in a substantial manner, very little objection could be made to such dwellings from a utilitarian point of view. Go, however, a little farther, and remember the pride Englishmen are noted to have in calling "their house their castle," which privilege they are deprived of in the adoption of the flat system. Also it should be the aim of the sanitary engineer to avoid crowding people together within the smallest compass by providing distinct dwellings for separate families.

The "through house," so common in Lancashire, with garden in front and yard behind, has many points worthy of our careful consideration, especially for an industrious family, or one with constant work or private means, who takes some pride in the cultivation of the garden, and sees that the yard is occasionally cleared of the rubbish of an untidy housewife. Then, perhaps, there is no class of dwelling so well adapted for the labourer and his family than this one; yet it is quite beyond the reach of the ordinary labourer to pay the rent for such a comfortable house. It therefore remains for him to take a through house in a street, with no garden, merely a

small yard behind, with privy and ash-place close to the dwelling, or live in a back-to-back house, now to be described.

In drawing your attention to the last-named house for the labouring class, the author would endeavour to show that the accommodation afforded by a well constructed back-to-back house is such as is best adapted to meet the requirements of those who constantly move from town to town in search of work, and that the rent is within the reach of nearly every man who is able to find five days work out of six. A back-to-back house occupies an area of about 36 square yards, having a frontage from 20 to 21 feet, and 16 or 17 feet in depth. The accommodation being, a keeping-cellar and coal-cellar below the surface of the street, a large living-room, with scullery, on the ground-floor, two bedrooms, and attic; by this arrangement a convenient room is obtained for the family during the day, and separate sleeping apartments for its various members at night. This accommodation is generally found to be ample for all ordinary families, and where more rooms are provided, they are frequently crowded with lodgers.

The approximate cost of erecting such a dwelling, in a substantial manner, is from 130*l.* to 140*l.* each, which includes paving and draining the moiety of the adjoining street. The value of the land is estimated at from 3*s.* 6*d.* to 4*s.* per square yard. The rent per week would be from 3*s.* 9*d.* to 4*s.* The landlord paying all rates and taxes chargeable upon the property. It is not advisable to allow a long row of such houses to be erected without a break for the free circulation of air.

In Halifax, and other towns in Yorkshire, not more than eight houses are allowed in one "block" when the front of the house forms the line of street, and a street of not less than 10 yards in width is required on both sides of the block; there is also a space 15 feet in width, from street to street, left at each end of the block, upon which is erected a privy and ash-place for each dwelling (sketch A).

You will observe the drains are kept entirely outside the building, and the lead pipe from the sink brought through the wall into a gully or trap placed in the street, level with the footpath or causeway, by this means the connection between the house drain and main sewer is broken, and any pressure of gas in the main escapes into the air, and not into the dwelling.

By sketch B you will notice back-to-back houses with garden or yard in front, and where the space or garden in front of any house

exceeds 150 square feet, the number of houses allowed in a block is unlimited; the privy and ash-tub being placed in front of each house.

The drains are arranged similar to sketch A, no drain being allowed to pass into the building, and all sinks are required to be against the outer wall. Land being taken as before, the rent of such house is about 4s. 6d. per week.

An objection is sometimes raised to the privy and ash-tub being placed in front of the house, and it is a very important one. Yet, where the tub or Goux system is adopted and properly carried out, the objection is more sentimental than real, for there should be no privy, but simply a tub or pan for the excrement, and no ash-pit, but merely a tub for ashes.

The great objection to back-to-back houses, is undoubtedly the difficulty of providing a suitable site for the privy and ash-place. Architects often devise means for keeping the necessary evils out of sight, by lowering or banking up the space or garden in front of the house. The accommodation placed at the end of the block is much to be preferred, for although a little farther to *walk* on a wet or windy night, the chance of any unpleasant smell arising in front of your door and windows, after a hot day or close night, is avoided, and you can open the windows without fearing any ill effects.

It was not always the writer's opinion that a back-to-back house was the best adapted for the labouring class. Some twelve years ago, when first visiting Halifax, he was astonished one morning to find himself located in such an abode, believing that a back door and yard accommodation was necessary for the ventilation and convenience of every Englishman's dwelling.

However, in course of time, his opinion has undergone a great change, and his sensitive feelings blunted, for under certain conditions a very comfortable house, with all modern sanitary arrangements, can be provided, and that at a cost to be within the reach of nearly everyone, so that he knows of no class of house to better fulfil the requirements of the labourer's family than the back-to-back house as shown on sketch A.

DISCUSSION.

Mr. LOBLEY: I might term the paper an apology for back-to-back houses, and I am greatly surprised to find they are still permitted to be erected. Under our bye-laws the smallest house permitted would be one having a frontage of 4 yards, and a depth (including the back yard) of 20 yards. The width of the street is 12 yards. Each house, therefore, absorbs 104 square yards of land, and has to pay for the formation of the street on a frontage of 4 yards. The back-to-back system requires a frontage of 7 yards to each house, and a depth of 5 yards. Assuming the width of street to be the same, and including the proportion of the spaces provided at intervals for closets, each house absorbs a total of 90 square yards of land, and has to pay for the formation of the street on a frontage (inclusive of the closet space) of 8 or 9 yards. It will not, therefore, be found that, in the items for land and street making together, the expense of the through house is greater than for the back-to-back house. The actual cost of building, room for room, will not be greater in the one case than in the other. There is no comparison between the two classes of house. In the through house you have two rooms on the ground floor, and two on the first floor, with a separate back yard and out offices. It is generally conceded that the ventilation is very imperfect in the back-to-back house, and, having only one aspect, many of them must exist into which the sunshine never enters. The through house is much better adapted to the comfort of a labourer and his family; and a couple without children would have room for lodgers. It is a significant fact that the house alluded to as being the smallest permitted by our bye-laws is very rarely built. By far the greater proportion of these dwellings have some addition in the shape of a back kitchen, sometimes with a room over; a cellar to be used as a larder, and a larger frontage. This is in a manufacturing town, where the houses have increased in the last twenty-one years from 6322 to 9178. The Government Model Bye-Laws would permit of a smaller through house, and also a smaller back-to-back house could be erected than the one alluded to. The principle remains the same, and it is not proved that there is any necessity for the back-to-back house, or that they are demanded by their very much greater economy.

Mr. S. G. GAMBLE: I must offer a protest against back-to-back houses, which I maintain are most objectionable, and tend to lower the morality of the tenants by their having to pass into the street to reach the w.c.

Mr. A. M. FOWLER: I have had great experience in the construction of back-to-back houses, especially in Leeds. It is not correct to say they cannot be properly ventilated; I maintain they can. There are blocks being built at Halifax, and others in Leeds, where a nice cottage is obtainable by a working man for 4s. a week. In Newcastle and other places you find families living on flats, and favourable reports are received from these houses, because generally there is a manager in the block, who picks his tenants. The proper result is not experienced under the Artisans Dwellings Act reform, because they will not have any one in these small houses. Leeds is a model town so far as the back-to-back house system is concerned. The streets are well paved with asphalt, and tenants do not experience the offensiveness of ash-pits and outhouses in close proximity to their doors. The working man has a good self-contained house without overcrowding, and consequently immorality is avoided. The question of contagion is therefore met in a more complete form than under the Artisans Dwellings Act, under which the "residuum" of the population is not provided for. Before discarding back-to-back houses entirely, I think the system should be carefully considered in all its bearings. I have not made up my mind to go in for the back-to-back house system entirely, but I have been thinking whether it is not as good a plan as the Artisans Dwellings Act system, as now understood and worked out.

Mr. J. HALL: I cannot too strongly condemn the back-to-back system of dwelling-houses, and I fail to see where the economy comes in. To generally adopt such a system would be to go back to the old times, long before any legislation took place or was considered necessary for sanitary purposes. In my opinion, every house should have a proper privy and ash-pit, or w.c. and dust-bin, provided. In my borough (Stockton), the working classes generally speaking live in self-contained cottages, for which they pay from 2s. 9d. to 4s. 6d. per week. Surely a cottage house at say 3s. 6d. per week is not a large amount of rent for a respectable labouring man to pay.

Mr. B. C. CROSS: I am very much surprised to find a gentleman with the experience of Mr. Escott in favour of the system of back-

to-back houses, of which I have had large experience in Dewsbury, where they are very numerous. The system is unknown, I believe, in the south of England. I fail to see why through houses should not be adopted in Yorkshire as elsewhere. I think the system described in the paper, especially as regards class B, for providing ash-pits near every house door, is pernicious, and I can hardly understand any man calling himself a sanitary engineer advocating such a system. In towns where the local authority has bye-laws requiring that 150 square feet of yard area should be allowed to each house, it is disgraceful to throw those bye-laws on one side and allow an estate to be crowded with as many houses as could possibly be put down. It is time this sort of thing was put a stop to, and I am glad the subject has been brought forward.

Mr. G. JENNINGS: When we had zymotic diseases amongst us, we always found that the greatest percentage of the disease was amongst the people inhabiting this class of houses, and from a sanitary point of view they ought not to be tolerated.

Mr. SCRIVEN: We are dead set against back-to-back houses in any part of the borough, and such dwellings are, in my opinion, very objectionable.

Mr. HEWSON: I prefer the double house for myself, and I think it is better for the working man. On the score of health and morality, back-to-back houses ought not to be allowed. If this class of dwellings had been discarded, and the double-house system had been cultivated in large towns, we would not have heard such an outcry as we have for fever hospitals. There would then have been a means of isolation sufficient to meet any epidemic.

Mr. J. HOLMES: I have had a deal of experience in regard to back-to-back houses, and am of opinion that there is nothing which so merits condemnation by sanitary engineers.

The CHAIRMAN said he thoroughly endorsed all that had been said against back-to-back houses, and he was glad to find there was so much unanimity of opinion in opposition to the system. From every point of view he thought it was reprehensible. Thorough ventilation could not be attained unless there were means, back and front, to admit a free current of air. His experience in regard to the building of workhouses led him to remark on the obligation which the Local Government Board put the authorities under in providing complete ventilation space between each block, from which it was evident that paupers and criminals were better looked after than the working classes.

The CHAIRMAN expressed the obligation of the Members to the Lord Mayor of York and the Corporation for allowing them the use of the Council Chamber, and he moved that a vote of thanks be accorded to them.

Mr. B. C. Cross seconded the proposition, and it was heartily accorded.

During the afternoon, the Members inspected the works of the North Eastern Railway Company, and the new bridge over the Ouse at Skeldergate Ferry, and visited the Museum grounds, which were thrown open to them, and other places of interest in the city. In the evening they dined together at Harker's Hotel.

DISTRICT MEETING AT SUNDERLAND,

April 22, 1882,

Held in the Committee Room, Municipal Buildings, Sunderland,

Mr. A. M. FOWLER, M. Inst. C.E., in the Chair.



The minutes of the previous meeting having been read and confirmed, the Secretary read letters from various Members who were prevented from attending.

The following papers were read and discussed :—

STREET LIGHTING OF THE FUTURE.

By W. G. LAWS, BOROUGH ENGINEER, NEWCASTLE-ON-TYNE.

THE great progress in electric lighting during the last three years has raised hopes in the public mind that we are shortly to have a revolution in our street lamps which will leave gas as far behind as gas, some thirty-five years ago, left oil. Whether this hope will be justified is yet uncertain, as, although the success of the electric light in itself is decided, its applicability to the wants of a town is by no means so sure.

Early in the present century Sir H. Davy succeeded in producing the electric arc between two carbon points, using for this purpose a battery of 3000 cells. Since that time the attention of electricians has been steadily directed to improving and cheapening the means of producing this light; and the invention and perfecting of the magneto-electric and dynamo-electric machines have given a great impulse to their labours, and finally crowned them with success.

Faraday's discovery of the induction of currents by magnets led to the construction of the first magneto-electric machine in 1833 by Pixii. This was speedily improved upon by Saxton, and again by Clarke, who gave it the form which practically it bears to this day, viz. that of a pair or series of pairs of coils of insulated copper

wire, which are put into rapid rotation within the field of a permanent magnet.

Each passage of a coil before the poles of the magnet induces a momentary current, and the speed being very great, these currents follow each other so rapidly as to be practically continuous, and being collected and carried off by proper conductors, can be applied to any purpose which was served by the ordinary battery current.

Since Clarke's time the chief improvement has been in the size and details of the machine; and now, by the application of sufficient "power," we can produce currents of electricity of almost any required strength.

It is interesting to follow the cycle by which the carbon of the coal, first, by burning (or oxidation), produces heat; secondly, this "heat," by means of the steam boiler and engine, is converted into "power"; and thirdly, this power, through the magneto-electric machine, into "electricity," which, finally, by Davy's discovery, produces "light."

Compare this with the shorter cycle, in which, by means of "heat," coal is distilled, producing gas, which being burnt (or oxidised) gives off again "heat" and "light."

Here we get a glimpse of the real problem on which depends the final success of one or other of these modes of obtaining light. In each case we begin with coal; by which cycle then is the light most conveniently and economically produced from it? It seems natural to say at once "By the shortest," since at each change in the cycle there is a loss. But then we see that the final product in either case consists of both "heat" and "light," and that upon the relative proportions of these depends the real efficiency of the method. Those who are familiar with the use of the "Bunsen" burner are aware that gas may be so burned as to give off much heat and little or no light. The object of the gas engineer is just the converse of this, viz. to produce much light and little heat.

To return to electricity, we have seen that it is possible to obtain the current in any quantity, and to convert it into light in a properly arranged apparatus.

Without entering into the details of the various lamps that have been tried (and their name is legion), we may separate them into three great classes:—

1st. Those which produce the electric arc proper, between two carbon points.

2nd. Those in which the passage of a current raises a thin thread of carbon or other refractory substance to incandescence.

3rd. Those which combine these two methods in the same lamp.

Of these three systems, the first, or "arc system," is that which can be most cheaply produced, but only in large quantities, viz. in lights of from 1500 candles upwards, the most usual sizes being 2000 to 6000 candles. In such lamps it may be roughly taken that one horse-power will produce a light of 2000 candles. Where lamps of such power can be used, as in railway stations, manufactories, &c., the light is all that can be desired, and can be produced cheaply, viz. at from 3*d.* to 6*d.* per candle per annum, counting 4000 hours to the year. For the same *amount* of light it compares favourably with gas, which costs from 1*s.* 9*d.* to 3*s.* 6*d.* per candle per annum.

In lighthouses, where a powerful and penetrating light is required, the "arc light" has long been supreme. The present writer well remembers the feelings with which, now many years ago, he first saw at the end of a rather stormy voyage the welcome gleam of such a light, and how strongly he was convinced of its peculiar fitness for lighting that great public highway the sea.

The second, or "incandescent," system gives a much softer and more manageable light, but at a much greater cost. Here the light from each lamp does not exceed from 15 to 30 candles, a very excellent size for private interiors, theatres, &c., but too small for street purposes. In this system one horse-power will produce a light of about 200 candles. The cost of production now becomes from 3*s.* to 4*s.* per candle per annum, in which renewals figure heavily, as so far the life of such a lamp does not exceed 1000 hours, thus necessitating at least four renewals per year. The light, however, is extremely manageable, and quite free from the great drawbacks of gas, viz. the heat and acid vapours produced. For mansions and private houses, and more especially for libraries and picture galleries, this light should have a great success. In such cases cost is a secondary consideration compared with comfort and convenience, besides the very great advantage of not having valuable books, paintings, or ornamental fittings damaged or tarnished.

The third system of lighting is at present chiefly represented by the Jablochkoff candle, in which the two carbons are laid side by side, and separated by a layer of incombustible substance, which is raised to incandescence by the passage across it of the electric arc,

and materially aids in the production of light. This system, however, has not had a great success, chiefly owing to the rather unsteady character of the light, and to variations in its colour, produced by impurities in the separating medium.

The "Lampe Soleil" is another example of the third system. In it the two carbons rest on a block of infusible mineral substance, over or through which the arc passes, rendering it partly incandescent, and giving a beautifully soft glow and a very steady light.

The elements of the problem of street lighting by electricity are now before us, and we find that the choice is practically limited to large lamps of about 2000 candles, placed at considerable distances apart, or incandescent lamps of 15 to 30 candles more closely spaced. The first gives a large *amount* of light at a small price per candle, the second a light not much better than ordinary gas lamps, at a considerably greater cost.

Taking as an example a street a mile long lighted by the arc system, the arrangement would probably be lamps 60 yards apart, placed alternately on either side, giving 30 lamps or 60,000 candles, at a cost of about 800*l.* per annum. If lighted by "incandescent lamps," we should have them placed about 30 yards apart on *both* sides, that is, 120 lamps, giving 2400 candles, at a cost of about 420*l.* per annum. The number of gas lamps for the same distance might be 150, giving about 2250 candles, at a cost of 300*l.* per annum.

In the first case the individual lights are much larger than necessary, and the cheapness per *candle* is neutralised.

In the second case, the gain in light over gas is trifling compared with the extra cost.

When the electrician succeeds (as doubtless will be the case some day) in giving us lights equal to say 200 candles, at about the same rate as in the larger arcs, that is, at about 3*l.* to 4*l.* per lamp per annum, then we may look to the electric light for a larger, better, and cheaper illumination in our streets than we now have.

At present we can, by the use of improved lamps, such as those of Bray, Sugg, and Siemens, get this improved light from gas at a cost of 18*l.* per lamp per annum, while from electricity it can only be got by using clusters of incandescent lamps, at a cost for the same amount of light of about 30*l.* per annum.

At present, then, the electric light is not ripe for economical street use, except in special cases where considerable areas can be covered by large lights.

The contest between gas and electricity for the possession of our streets is not yet over. So far it has chiefly resulted in stimulating the gas engineers to increased effort in burning their gas to better effect, and thus the public has reaped a very substantial benefit. While the electric light was a mere scientific toy the gas companies were content to enjoy the large profits of their monopoly without much effort to improve their product. This apathy has been rudely shaken, and now they are striving hard to give us better light from the same gas. Whatever be the ultimate result of the conflict, the public must be the gainers, and we, to whom the matter is of great professional interest, may be content to aid by facilitating the trials and efforts of either side, sure that in the end we shall have a better and cheaper "Street Lighting of the Future."

DISCUSSION.

The CHAIRMAN: This subject is being taken up in all the chief towns, and I have no doubt we shall be able to elicit some information from the discussion of it, it being a most interesting question to us as engineers.

Mr. JAMES HALL: It is a drawback that the author is not here. There may be those present who wish to ask questions on the paper just read.

Mr. SPENCER: I am sorry Mr. Laws is not present, as the chief outcome of these papers is to ask questions. There are several important questions with regard to improved gas lights, but as Mr. Laws is not here, they cannot be answered. To the action of Edison and others we must attribute many of the recent improvements in gas and gas apparatus; for though the electric light is even yet in its infancy, it has caused the makers of gas to bestir themselves in improving gas and gas apparatus. I observe that the author of the paper comes to the conclusion that there is no electric lamp suitable for street lighting. A brilliant light can be concentrated on a given point, but it is costly, and the small incandescent lamp is of no use in street lighting. In fact, neither are in every respect so good as gas. The larger lamps throw a brilliant light on main streets and open spaces when used for street lighting, but the minor streets are left in darkness. This is not what is wanted. For police purposes, for cleanliness, it is the back streets that require lighting. Then there is the question of cost. Not only is a good light wanted, but a cheap light. I do not wish to be thought a

depressing prophet, and will say that a suitable lamp may yet be forthcoming, if not in our time, at least in near the future. The advantages of the electric light in giving out no heat we may accept as correct. With regard to the various lamps, the Jablochkoff candle is behind the age. The Lampe Soleil gives a beautiful, soft, steady light, but will not light up a large space. On the whole, the cost seems against the electric light, and it is doubtful whether it is better than the improved gas light. The smaller electric lamps are useful in some instances, where cost is no object, and the more powerful lamps may be used in lighting large spaces to advantage but they have the drawback of casting deep shadows.

Mr. JAMES HALL: In Stockton, where the Corporation are the proprietors of the gasworks, it is their interest to cope with this question. The electric light has been introduced into several of the large works, where there is a surplus of steam power at hand. In street lighting, several kinds of improved gas lamps have been introduced, and Bray's has been found to suit best. In the exhibition held at Stockton a short time ago, there was a competition between the gas and electric lights, in which the latter did not play a very important part. On the opening night something went wrong and they had to fall back upon the improved gas lamps, and all through the electric light was anything but steady. I think Mr. Law's estimate of the cost of improved gas lamps is too high. We have fixed nine lamps in Stockton, and found that the cost was about 12*l.* instead of 18*l.* But there are hopes of better gas lamps. I am told that an Edinburgh gentleman has patented an improved gas lamp which, if it fulfils all that is claimed for it, is better and cheaper than any yet brought out.

Mr. ROUNTHWAITE: The question has been under our consideration, and experiments have been made. Four of Sugg's lights have been erected, and the gas company have generously charged the same as for ordinary lamps.

The CHAIRMAN: There can be little doubt that there has been a competition between gas and electric lighting. When first the electric light was brought before the public in something like a practicable shape, gas shares went down; but they have recovered since then, and great improvements have been made in gas lamps and lighting. When preparing the plans for the free library at Newcastle, I made arrangements for introducing the electric light if found practicable. I found, however, that the system was not then matured. I went minutely into the cost, and found that it was

considerably more than gas. But gas is very destructive; all librarians can tell of the destructive effects of gas. This was my reason for going so minutely into the cost. I even went to the trouble to endeavour to apply water power from the streams and sewers in the town, but I could not get sufficient force. I found that the electric light would be so expensive that I did not even report what I had done to the committee. With regard to improved gas lighting, there is a good example at Manchester, where a whole street is lighted with Bray's lamps, placed about 30 yards apart. The effect is novel and striking, the lamps giving a brilliant and beautiful light.

Mr. DOWNIE: I gather from the paper, and the remarks of those who have spoken that the electric light is not yet sufficiently developed to be of use for street lighting. The cost, if nothing else, is against it. But if water power could be used in the place of steam, as the chairman suggested, the cost would be lessened, and in the near future the light might come into general use.

The CHAIRMAN: In discussing the question, the consumption of gas per hour should be known. Some street lamps give a very poor light. Mr. Swan bases his on 20 candles.

Mr. DOWNIE: Are there any diagrams to illustrate the paper? They would greatly help the discussion.

The CHAIRMAN: The Secretary says there are no diagrams. It is a pity Mr. Laws is not present, he might have helped us out of some of our difficulties.

Mr. SPENCER: In the absence of Mr. Laws we cannot arrive at a proper idea of the cost of the rival lights as set forth in the paper. There is another matter to be considered in relation to the electric light, and that is the colour. Use is second nature, and it may be that we have got used to the colour of gas light, but there can be no question about the green light of the electric lamp being disagreeable. Of course, some lamps give a white light, but even that is not very agreeable unless toned down.

Mr. THORBOLD: I have great pleasure in moving that the best thanks of the meeting be given to Mr. Laws for his valuable paper. I should have been pleased if there had been more discussion, but in the absence of Mr. Laws I cannot see how this could have been. I would just like to point out one thing. The question of "street lighting" is one of considerable importance, especially to districts not possessing gas works of their own, being entirely at the mercy of companies or corporations having a monopoly of the lighting

department. Mr. Laws says that the electric light has great penetrative powers. I have been led to believe that this is not so. The gas and electric lights were some time ago tested at the House of Commons in respect to this quality, when the clock tower was lighted with both lights. At first the night was clear, and the electric light seemed to be the better of the two. After a while, however, a fog came on, when it was found, that while the gas light remained visible, the electric light was entirely obscured. This I understand is accounted for by the electric light being deficient in red heat-bearing rays.

Mr. SPENCER: I have no doubt but that the gas light is the more penetrating of the two lights, that is, if the power is equal.

The CHAIRMAN: I have made a note of this, in order that Mr. Laws' attention may be drawn to it.

Mr. SPENCER: I think the green rays of the electric light somehow assimilate with the grey fog, and so prevent it from being seen at a great distance. I have great pleasure in seconding the vote of thanks.

The motion was carried by acclamation.

APPORTIONMENTS OF PRIVATE IMPROVEMENT WORKS.

By JAMES HALL, C.E., BOROUGH SURVEYOR, STOCKTON.

One of the most important clauses in the Public Health Act, 1875, is that giving power to local authorities to sewer, pave, &c., private streets. The clause is the 150th, and reads as follows:—

“ Where any street within any urban district (not being a highway repairable by the inhabitants at large), or the carriage-way, footway, or any other part of such street is not paved, sewered, levelled, metalled, flagged, channelled, and made good, or is not lighted to the satisfaction of the urban authority, such authority may, by notice addressed to the respective owners or occupiers of the premises fronting, adjoining, or abutting on such parts thereof as may require to be sewered, levelled, paved, metalled, flagged, or channelled, or to be lighted, require them to sewer, level, pave, metal, flag, channel, or make good, or to provide proper means for lighting the same, within a time to be specified in such notice.

“ Before giving such notice the urban authority shall cause plans and sections of any structural works intended to be executed under this section, and an estimate of the probable cost thereof, to be made under the direction of their surveyor, such plans and sections to be on a scale not less than 1 inch for 88 feet for a horizontal plan, and on a scale of not less than 1 inch for 10 feet for a vertical section, and in the case of a sewer, showing the depth of such sewer below the surface of the ground ; such plans, sections, and estimate shall be deposited in the office of the urban authority, and shall be opened at all reasonable hours for the inspection of all persons interested therein during the time specified in such notice, and a reference to such plans and sections in such notice shall be sufficient without requiring any copy of such plans and sections to be annexed to such notice.

“ If such notice is not complied with, the urban authority may, if they think fit, execute the works mentioned or referred to therein ; and may recover in a summary manner the expenses incurred by them in so doing from the owners in default, according to the frontage of their respective premises, and in such proportion as is

settled by the surveyor of the urban authority, or (in case of dispute) by arbitration in manner provided by this Act; or the urban authority may by order declare the expenses so incurred to be private improvement expenses.

“The same proceedings may be taken, and the same power may be exercised, in respect to any street or road of which a part is or may be a public footpath, or repairable by the inhabitants at large, as fully as if the whole of such street or road was a highway not repairable by the inhabitants at large.”

The first paragraph refers to the nature of the works for the performance of which powers are granted, and also directs that notices, &c., should be given to the owners. The second paragraph relates to the necessary plans, sections, specifications, &c., which must be prepared for the guidance of all or any of the owners who may desire to carry out the work themselves.

In the third paragraph, power is given to the urban authority to do the work, and directs how the cost of such work is to be charged to the individual owners. It is this paragraph particularly that the writer wishes to draw attention to. The Act states that the proportion must be according to the frontage of each premises. Several sanitary authorities have adopted a system of simply charging the superficial area of paving and flagging and the lineal measurement for sewer, channel, and kerb, and charge according to the width of the street opposite the respective premises. In the case of a corner site the owner pays for two frontages, and one quarter of the square formed by the junction of two streets, and half the width of any back or side street, is added to the actual frontage of the property. This system, the writer thinks, is not correct either in law or equity, and for this reason, that the cost of the square formed by the crossing of two streets should be evenly and properly divided according to the frontage or the various properties in each of those streets, and that the frontage of any back or side street should be paid for by all persons who use such street, or have property abutting thereon.

The writer's system is as follows :—The total cost of paving, &c., a street is obtained and summarised under the following heads, viz. paving, &c. (which includes cost of surface drainage), flagging, kerbing, and superintendence, printing, &c. In back streets where there is no flagging and kerbing these items are omitted. It is found that 5 per cent. is a fair charge on the total cost to defray all costs out of pocket for printing, superintending, &c.

The lineal frontage of each premises is then measured, and the aggregate of these frontages divided by each separate frontage, which gives the fair value of the work done abutting upon each separate premises.

The justice of this system must be manifest to all. Supposing that a street was 10 feet wider at one end than the other, the whole of the owners of the street have the same rights of way over the surface of the street at the narrow as well as at the wide part. Again, should each separate block of property be provided with its own surface-drain and gully-trap? Or, if it should be considered desirable that a couple of feet of earth should be taken off one part of the surface and a hollow filled in another, should the premises abutting upon those particular places be charged an extra cost when the whole street would benefit by the improvement?

The writer is sorry that circumstances have prevented him from entering more fully into this subject, but trusts that the few remarks he has made will lead to a discussion, and an interchange of ideas by the various gentlemen present who are surveyors and engineers to sanitary authorities how they apportion their private improvement expenses.

DISCUSSION.

The SECRETARY read a paragraph from a Sunderland newspaper, giving a report of a case tried before the borough magistrates, in which the Corporation were non-suited in their endeavour to recover private improvement expenses.

Mr. JAMES HALL: I may say that in Stockton, where the apportionment is in accordance with the Stockton Improvement Act, we have never lost a case brought into court.

Mr. DOWNIE: I would like to hear the views of the Members present on this paper. It brings out several important questions. Supposing a street is 18 feet wide at one end and 31 feet wide at the other, would it be fair to charge all the owners in the street according to their frontage? I think it is unfair, though it is according to the Act. Then there are corner sites and crossings. I would like the opinions of the Members on this matter.

Mr. CREER: I think, according to the Public Health Act, the street may be divided into sections, and apportioned accordingly.

Mr. ROUNTHWAITE: Have you the section?

Mr. CREER: I am referring to the 150th section. It should

be understood that corner sites must pay up to the centre of the cross streets. If this were done the extra cost of street making to corner lots would be taken into consideration by the purchaser. I have divided the work into "general" and "particular," placing items common to all under the head of "general" and apportioning according to the frontage and items of special work done, under the head of "particular," and charging direct to the properties opposite which it was done. It would be unfair to charge owners with work already done. I treat them as part contractors, measuring up the whole of the work, and crediting those who had done their work with their proportion. I hope there may be a good discussion on this subject, as it is one on which we should all have something to say.

The SECRETARY read the 150th section of the Public Health Act.

Mr. DAWSON: I have here an opinion of eminent counsel that has an important bearing on the question under discussion, and with the permission of the meeting I will read it.

The CHAIRMAN: I think the reading of the opinion will be acceptable to all present.

Mr. DAWSON then read the opinion as follows:—

"The Benwell and Fenham Local Board, having determined that certain private streets within their district were not sewered, levelled, paved, metalled, flagged, channelled, made good, or lighted to their satisfaction, instructed their surveyor to prepare the necessary plans, sections, and estimates, and these having been deposited in the Board Offices, the notices under Section 150 of the Public Health Act, 1875, calling upon the owners or occupiers of street frontages to execute the works of street formation specified in such notices, were given, and these not having been complied with, the Local Board on the 3rd November, 1880, borrowed the sum of 4000*l.*, under sanction from the Local Government Board, in order to enable them to execute the necessary works of private street improvement. The money was borrowed at 4½ per cent. over a period of twenty years. The Board commenced the works of paving, flagging, &c., without delay, which extended over a period of a year (more or less).

"The private streets being now completed in accordance with Section 150 of the Public Health Act, 1875, the Board are now engaged in preparing their calculations for the apportionments of the expenses among the owners of street *frontages both in front and back streets*, and are calculating the interest at 5 per cent.

(under Section 213 of the Public Health Act, 1875) from the date of the borrowing of the money, viz. the 3rd November, 1880.

“The surveyor has calculated his apportionments upon the total cost of all the streets, taking the whole as a private improvement district, and he reports that the cost of completing each street is exactly the same in proportion to its length, and that therefore the result is the same whether the apportionments are taken upon the whole or upon each street separately.

“The Board propose to declare the works of street formation, &c., to be private street improvements, to serve a notice of demand with the notices of apportionments, and after the expiration of three months from the date of the service of the notices, to make and levy a private improvement rate upon the total sum expended, and calculated in the same manner as the apportionments—but over a period of thirty years.

“The Local Board being anxious to keep strictly within the Public Health Act, will be glad to have the opinion of counsel upon the following queries, and to be advised generally upon their position:—

“Q.—Can the Board calculate the interest from the date of borrowing the money? should they not calculate the interest from the time when each street was respectively finished? and should not the owners or occupiers in each street pay interest at 5 per cent. from the date of the completion of their particular street? (To take the case of the street which has been last completed, it seems unreasonable to require the owners and occupiers in that street to pay interest upon money before it was applied for the formation of their particular street.)

“A.—The whole cost of the works executed in the streets in question being recoverable from the owners or occupiers of the adjoining premises, as distinguished from the ratepayers of the district at large, the whole of the interest which the Board are liable to pay upon the loan raised by them for executing the works, as well as the principal expended by them on the works, is, in my opinion, chargeable on such owners or occupiers. And although part of the money borrowed may have been borrowed before the Board actually required to expend it on a particular street, this does not appear to me to render the district at large liable to pay interest on the loan between the time when it was raised and the time when the money was expended instead of the persons for whose special benefit the loan was raised.

“Q.—Should the surveyor not have taken each street separately,

and have apportioned the cost of that street only among the owners and occupiers of frontages in such street? Assuming that the result is the same whichever way the calculations are taken, will not the onus be upon the Board to prove that this is the case, and if so, is it not better to take the calculations by separate streets, and so get over any question upon the point, seeing that if the Board failed to prove the fact the apportionments would be bad?

"A.—I am of opinion that the proper course for the Board to adopt is to treat each 'street' as independent of the others, for they have no power under s. 150 of the Public Health Act, 1875, to charge any owner, in respect of his premises in one street, with expenses incurred by them in executing works in another street. If they did not distinguish the several streets, and the expenses incurred in each, the apportionment or private improvement rate, as the case might be, on any premises would, in my opinion, be open to objection, and the onus would be on the Board to show that the method adopted by them made no difference to the ultimate result; though the recent case of the Shanklin Local Board *v.* Miller (42 L.T. (N.S.), 738; L.R., 5 C.P.D., 272) shows that if the question were not raised, in the case of an apportionment, before the surveyor (and by analogy, in the case of a private improvement rate, on appeal) it would be too late to raise it when the Board were proceeding to enforce payment.

"Q.—Should the Board declare the street works to be private improvement expenses under s. 150 at soon as the apportionment notices are served? and should they not serve a notice of demand with the notices of apportionment?

"A.—The apportionment of the expenses, that is according to frontages, and the declaration of the expenses to be private improvement expenses, are distinct and alternative modes of proceeding (see the third clause of s. 150). If the latter course be adopted, the rate is independent of the frontage, and depends, as in all other rates, upon the rateable value of the premises upon which it is imposed. If the former course be adopted, a demand served with the notice of apportionment would be void, for there would be no sum then demandable. A valid demand for payment cannot be served upon the owner until the three months during which he is at liberty to dispute the amount apportioned upon him have expired; see *Grece v. Hunt* (L.R., 2 Q.B.D., 389; and *Simcox v. Handsworth*, L.R., 8 Q.B.D., 39).

"Q.—Should not the private improvement rate proposed to be

made be made and levied upon the owners and occupiers in each separate street, and based upon the cost of each particular street, with interest at 5 per cent. from the time of completing each street? Should it be made over a period of thirty years, seeing that the 4000*l.* is only borrowed for twenty years?

"A.—A private improvement rate can only be made and levied upon the occupiers of the premises, and not upon the owners (see s. 213); though the occupier may, under s. 214, deduct part of it from his rent. A separate rate should, in my opinion, be made annually, half yearly, or otherwise, in respect of each street, for the purpose of repaying so much of the loan as has been expended upon such street, and the interest payable by the Board on that portion of the loan. The loan being repayable in twenty years, the Board must within that time obtain from the owners or occupiers the amount required to repay it, with such interest as they may have agreed to pay upon it; otherwise there would be a charge upon the general district rate.

"Q.—Should this rate be made and levied when the notices of apportionment are served or after the expiration of the three months allowed for objections? (It is understood that the time within which the rate may be recovered will not run during these three months.)

"A.—The second paragraph of s. 257, making the surveyor's apportionment conclusive if not disputed within the three months, relates only to expenses payable by owners, and not to private improvement rates, which are recoverable from the occupiers under s. 256.

"Q.—The surveyor, in addition to the interest at 5 per cent., proposed to add another 5 per cent. to cover collection expenses, can this be done? and if not, can the Board charge collection expenses?

"A.—If it is not part of the collector's duty to collect all rates made by the Board, I think that the estimated cost of collecting each private improvement rate might be added to the estimate to be made for such rate under s. 218.

"Q.—In the event of there being any loss as between the interest paid by the Board upon the 4000*l.* and that paid by the owners or occupiers of street frontages, how can such loss be made good?

"A.—The Board should, as above-mentioned, cause the apportionments or rates to be so calculated as to allow them to repay the whole of the loan with interest out of the money to be recovered from the owners or occupiers. If the expenses are apportioned on

the owners, they will be charged on the premises by s. 257, and may no doubt be recovered without loss. Should a private improvement rate in respect of any premises become irrecoverable for any other reason than because they are unoccupied (in which case the owner becomes liable under s. 213), I think that the loss should fall on the persons liable to that rate, and not on all of those liable to the general district rate.

"If the loan is charged on the first-mentioned rate, the remedy of the lender would be against that rate; but the last clause of s. 234, in my opinion, requires the Board to make good (i. e. to the ratepayers of the district at large) both principal and interest out of private improvement rates, if the expenses have been declared 'private improvement expenses.'"

The CHAIRMAN: I am sure we are all very much obliged to you, Mr. Dawson, for the opinion. I suppose the case is now pending.

Mr. DAWSON: Yes.

Mr. SPENCER: Those who attempt to explain the different Acts of Parliament must face the difficulties. The reason of these difficulties was recently forcibly hinted at in one of the comic papers. The picture represented the career of a boy, who, after failing in almost everything, at last finds permanent employment and success in framing Acts of Parliament. However, some of the points in the 150th section of the Public Health Act are definite enough, and that which relates to frontage is one of them. There is no getting over it. You can't lump the whole. The work done must be measured up, whatever the width of the street may be, and charged according to the frontage. The Acts are drawn up by lawyers alone, and so are generally wrong. It has always been my opinion that 5 per cent. profit was a proper charge, and Mr. Glen's opinion has cleared away any doubts I might have had. As to the collecting, in many towns and districts the surveyor's and other expenses are thrown in. Mr. Glen seems to think that if the collector does no other work, it may be charged. I hope this discussion may be extended, and adjourned till we have a larger meeting.

Mr. ROUNTHWAITE: I cannot agree with Mr. Spencer in the view he takes. I think the street should be measured as a whole, and apportioned accordingly. I think the Act shows this. It would not be fair to make an owner pay for a lamp because it happened to be opposite his property. The street, like the lamp, is for the benefit of all the owners in the street, and the cost should be spread over the whole.

Mr. SPENCER: I was referring to flagging, &c.

Mr. ROUNTHWAITE : I think the street is for the benefit of all the owners, and should be measured and apportioned accordingly. Each owner should pay according to his frontage. This view has been upheld in the highest courts. As to corner sites, if the whole street is taken, there can be no difficulty.

Mr. M. HALL : It would be very unfair to charge crossings to the owners. I think the cost of street gullies and crossings should be paid out of the rates.

Mr. JAMES HALL : We make no distinction between paving, gullies, &c.

The CHAIRMAN : I would call attention to the fact that these streets are not for the sole benefit of the Corporation. Private improvement works are done for the individual, and for his benefit. Mr. Glen takes the view that the owner should pay. Is it fair that the owner who widens a street should not pay extra? Every owner should pay according to his frontage. With regard to corner sites, the owner has all the advantages, and should pay. I think this is a very important question, and would suggest that it be adjourned to the next meeting.

Mr. SPENCER : I beg to move that the discussion of this subject be adjourned to next meeting.

Mr. HAWDON : I have pleasure in seconding the motion.

It was therefore resolved accordingly.

Mr. ROUNTHWAITE : I beg to move that a hearty vote of thanks be accorded to Mr. James Hall, for his interesting paper, and hope that it will be thoroughly discussed at the next meeting.

Mr. HAWDON : I beg to second that, and with Mr. Rounthwaite hope the subject may be well discussed at the next meeting.

Carried by acclamation.

The SECRETARY moved, and Mr. HAWDON seconded, a vote of thanks to the Chairman, which was carried by acclamation.

The CHAIRMAN replied, and moved a vote of thanks to the Secretary for his services on behalf of the Association ; to the Mayor of Sunderland for the use of the Committee Room ; and to Mr. A. Baird for his kindly entertainment of the Members.

Mr. JAMES HALL seconded the motion, and it was carried by acclamation.

The meeting then adjourned.

During the day the Members, under the direction of Mr. Rounthwaite, visited the various places of interest in the town.

DISTRICT MEETING AT GOOLE,

June 17, 1882.

Held at the Lowther Hotel, Goole.

Mr. E. PRITCHARD, Past President and Hon. Sec. for the
Midland District, in the Chair.

In opening the meeting the Chairman said he was sure they would enjoy the bill of fare provided. They had two papers to be read, and he congratulated the Association on stepping out of the sewage line somewhat, as a relief. They had had every recurring question as to sewage and the various matters in connection with the supply of water, and that kind of thing; so that it was a relief to have these two papers from gentlemen who, he was pleased to say, were qualified to give an opinion; and he thought the meeting would have great pleasure in listening to them.

The following papers were then read and discussed:—

EXTRAORDINARY TRAFFIC ON HIGHWAYS BY TRACTION ENGINES AND THE LOADS THEY DRAW.

By JOHN HENRY TAYLOR, Assoc. M. Inst. C.E., Borough
Surveyor, BARNESLEY.

Among the numerous difficulties connected with the satisfactory performance of the duties of an Engineer and Surveyor to Urban and Rural Sanitary Authorities, the author thinks it may be taken for granted that those in connection with the working of the 23rd section of the Highways and Locomotives (Amendment) Act, 1878, may fairly be numbered.

Section 23 states that: "Where by a certificate of their Surveyor it appears to the authority which is liable or has undertaken to

repair any highway, whether a main road or not, that having regard to the average expense of repairing highways in the neighbourhood, extraordinary expenses have been incurred by such authority in repairing such highway by reason of the damage caused by excessive weight passing along the same, or extraordinary traffic thereon, such authority may recover in a summary manner from any person by whose order such weight or traffic has been conducted, the amount of such expenses as may be proved to the satisfaction of the court having cognizance of the case to have been incurred by such authority by reason of the damage arising from such weight or traffic as aforesaid.

“ Provided, that any person against whom expenses are or may be recoverable under this section, may enter into an agreement with such authority as is mentioned in this section for the payment to them of a composition in respect of such weight or traffic, and thereupon the persons so paying the same shall not be subject to any proceedings under this section.”

The author is well aware that, up to the present moment, many of the municipal authorities of this country have practically ignored this section, but it will no doubt be agreed that very soon these authorities will be bound to enforce its provisions or some amendment of the same.

For it must be evident to many that if steam traction engines are to be allowed to traverse our highways drawing the loads that they are known to do, the expenses of the repair and maintenance of such highways will be most seriously increased; in short, it may be stated as a fact that within the Borough of Barnsley, with which the author is actively connected, such repairs through excessive weights and extraordinary traffic have been increased upwards of 40 per cent., and in the parish of Edith Weston, referred to in the recent case of *Aveland v. Lucas*, the cost of the repairs of the highway in question was increased from a rate of 15*l.* 6*s.* 11*d.* per mile to 102*l.* 7*s.* 2*d.* per mile, or an increase of about 680 per cent.

Now at first sight, the reading of the section here under consideration appears clear and definite to surveyors, particularly as it appears to give to them the power to certify the amount of the extraordinary expenses incurred through extraordinary traffic or excessive weights, still its appearance at first sight and its practical carrying out are two different things.

In the first place, it becomes incumbent that an account of the average expenses of the maintenance of the highways in the neighbourhood where such extraordinary repairs have become necessary shall have been duly kept; but is it not a fact that in many districts this account has not hitherto been kept?

How then in these districts will the authorities be able to recover the expenses for extraordinary traffic, &c. ? Are they to trust to the good disposition of the magistrates to administer the intention of the framers of the Act; or are they to abandon their claims ?

Further points about which questions arise in the minds of ordinary thinking people are: "What is excessive weight?" and "What is extraordinary traffic?"

Neither this section nor any other in the Act gives the definition or interpretation of these terms. But as if to make them more vague and indefinite, or to prevent all occasion for claims for extraordinary traffic, &c., Section 28 proceeds to fix the maximum weights of road locomotives and the minimum widths of the tires; and Section 32 gives power to county authorities to make, alter, and repeal bye-laws for the regulation, and to grant licences for the use of such road locomotives, thus conveying the impression to the users thereof, that beyond the amount of the licensing fee no further tax or charge will become due from them.

Again, take it for granted that the average expenses of maintaining highways were, in every case, known, another difficulty arises before the surveyor can make out his certificate; this difficulty may be illustrated as follows:—

It will be the case with some here present, that for ordinary traffic the same length of macadamised highway after having been "coated" will then last, say, four years, before this process of "coating" is repeated. Take it, as a matter of supposition, that in the third year of the life of this "coated" length of highway, traction engines begin to traverse it, and at the end of that year, extraordinary repairs have to be executed. How are these extraordinary expenses to be determined?

If this said length of highway for ordinary traffic cost 100*l.* for four years' wear, or at the rate of 25*l.* per annum, and the repairs for extraordinary traffic cost say 120*l.*, who is to say for how many years these latter will last, with extraordinary traffic passing along,

in order that a comparison may be made of the cost for ordinary and extraordinary traffic?

Again, it is frequently stated that it is altogether impossible for any surveyor, however able and competent he may be, to equitably certify or apportion the amount of damage by extraordinary traffic, &c., done to the same length of highway by, say, six several traction engines, the property, or used by the order, of six different people. For it frequently happens that no two traction engines are alike in their own weights and dimensions or in the weights they draw.

As an instance of this, I have prepared a table, showing the weights, dimensions of wheels, and other particulars of eight different traction engines and waggons which have been at work in this borough:—

Progressive No.	Weight of Traction Engine.	Dimensions of Driving Wheel.		Dimensions of Front Wheel.		Weight of each Empty Waggon.	Average Weight of Load in each Waggon.		Dimensions of Waggon Wheels.		Dead Weight on Roads of Traction Engines at rest.	Dead Weight on Roads of loaded Waggons at rest.	Dead Weight on Roads of 16-ton Steam Roller.
	tons.	ft. in.	in.	ft. in.	in.	tons.	tons.		ft. in.	in.	per lb.	square lb.	inch. lb.
1. Corporation Road Roller	15	5 5	20	3 7½	25	..	..	..	..	..	..	..	401
2.	9	7 0	17	4 0	12	2½	5	{	3 9	× 6	347	700	—
3.	8	5 6	15	3 4	10	1½	3	{	3 3	× 6	359	420	—
4.	7	7 0	15½	3 6	8½	2½	4	{	3 3	× 6	326	456	—
5.	10	7 0	17½	4 0	9	3	7	{	3 7½	× 8	423	606	—
6.	6½	5 6	16	3 6	10	1½	6	{	3 4½	× 8	280	800	—
7.	8	5 4	16	3 0	9	2	3	{	3 1	× 9½	359	464	—
8.	6½	5 6	10	3 6	10	2	3	{	3 5	× 9½	364	295	—

Again, the variation in the gradient of each separate highway traversed, and the velocity at which each individual traction engine travels, are factors in the case, and ought, or might, be taken into account.

Now, although the Locomotive Act of 1865 proscribes the velocity of road locomotives from exceeding two miles per hour in towns, it is known from observation that their actual rate of speed varies from four to six miles per hour, and that although it would be necessary to have only an ordinary pressure upon the piston of a traction engine for this statutory velocity of two miles

per hour, yet, as a fact, the pressure at which the traction engine is actually worked is from 90 lb. to 100 lb. on the square inch. And it must be borne in mind that the friction and pressure of a traction engine increases as the velocity and propelling power are increased, after the velocity of two miles per hour and the pressure on the piston necessary to maintain this ordinary velocity have been increased.

The foregoing are only some of the difficulties which crop up in the carrying out of this Act; but as the principal object of this paper is not the raising of difficulties in the carrying out of a surveyor's duties in relation to this Act, but rather to elicit opinions as to the best way of removing them, the author will briefly give his views with that object.

In the first place, the Corporation with which the author is connected had their attention drawn to the fact that heavy damages were being caused to their highways by traction engines and the loads they drew. They therefore determined to put in force the 23rd section before referred to.

Observations were taken throughout the borough recording the number of journeys, highways traversed by, and the weight and description of each traction engine and its load, and from these observations a tabulated statement was prepared, giving the tonnage, &c., passed over each highway by each traction engine.

A particular highway damaged was then repaired, and the exact cost of the repairs recorded in the usual manner. The average cost of repairing the same highway for some years previously was also obtained, and was found to be 84*l.* 5*s.* per annum, or say for three years 252*l.* 15*s.* for ordinary traffic.

The actual cost of the repairs for extraordinary traffic was 358*l.* 7*s.* 6*d.*, and the author estimated that these repairs would be sufficient for the three following years with extraordinary traffic, giving the traction engine owners the benefit of trifling repairs in the meantime.

The difference between the cost of repairs for	£	s.	d.
extraordinary traffic, viz.:	.	.	358 7 6
And the cost for ordinary traffic	.	.	252 15 0
viz.:	.	.	<u>£105 12 6</u>

was apportioned as follows, viz. :—

Name of Owner of Traction Engine.	Number of Journeys.	Tonnage.	Amount apportioned.		
<i>a</i>	1260	36,540	£	s.	d.
<i>b</i>	120	3,760	6	8	4
<i>c</i>	360	11,060	18	16	8
<i>d</i>	180	5,400	9	4	2
<i>e</i>	180	4,860	8	5	5
<i>f</i>	5	—	—	—	—
<i>g</i>	20	400	0	13	4
<i>h</i>	5	—	—	—	—
Total		62,020	105	12	6

From the manner of making the foregoing apportionment, the following points are worthy of notice; viz. :—

(a.) There must have been, and in fact there was, a great deal of time occupied in obtaining the requisite observations, records, and average costs, necessary to make the apportionment in an equitable manner.

(b.) Traffic over this particular highway by means of carts, waggons, carriages, &c., by team labour was considered to be ordinary traffic.

(c.) The traffic, in fact the tonnage, named in the foregoing table of apportionment, that might have been carried over this said highway by the same people who now own the traction engines, had they conveyed such traffic by ordinary team labour, &c., was in no way allowed for in making the apportionment, and very properly so too, for the author considers that the roadways of ordinary well-managed cities and boroughs are quite capable of bearing the traffic conducted in the ordinary way, that is by team labour, without appreciably feeling the expense of the requisite repairs, and therefore the author thinks that such corporations can well afford to ignore the question of extraordinary traffic in their case; but as regards road locomotives the case is altogether different, the damages done by them being too apparent to escape notice.

Before passing away from this question of repairs, ordinary and extraordinary, the author would draw attention to the advantage of the use of the 15-ton steam road roller in repairing roads that may be used by steam traction engines, and would strongly recommend those gentlemen present who have not already got one, to go in for one; they will be recouped fourfold for the interest on the outlay in the saving of repairs afterwards.

SUGGESTED AMENDMENTS TO THE ACT.

The author would suggest that the Act in question be amended in the following particulars, viz. :—

That the term “extraordinary traffic” shall mean and include the carriage along the highways, by means of ordinary team labour or by road locomotives, of all goods or merchandise, foreign to or not directly connected with, the staple trades or industry of the district of the particular authority of the highways traversed; or the carriage of goods and merchandise along the highways of any authority by means of road locomotives, no matter whether the same shall have been licensed to travel by the proper authority or not.

Section 32 to be amended so as to confer upon every highway authority power to make, alter, and repeal bye-laws for the regulation of road locomotives, such bye-laws to be subject to the approval of a central highway authority to be formed in London, and to grant licences to road locomotives to travel through their district by any highway authority, provided always that in case of the refusal of any local authority to grant such licence, the reason for such refusal shall be at once communicated by the local, to the central authority, who shall have power, if they think such reasons for the refusal unfair, to require the local authority to grant a licence.

Section 23 to be amended so that the charge for extraordinary traffic may be levied by a charge of any amount, not exceeding one penny per ton per mile of macadamised highway traversed, or not exceeding threepence per ton per mile of paved highway traversed; or by the difference between the cost of repairs for ordinary and extraordinary traffic.

The term “excessive weight” to mean the weight of any road locomotive, empty or loaded cart, wain, or waggon drawn on any highway, greater than is allowed in the 28th section of this Act, or in the above-named bye-laws; cases of traffic by excessive weight to be dealt with summarily before the magistrates and treated as misdemeanour.

In conclusion, the author is afraid the interest of this paper is not sufficient to have warranted him in wearying the patience of the meeting by its length.

But the author would record his strong conviction that the whole

question of the repairs of the highways throughout the country, and the extraordinary traffic along the same by road locomotives, must come more prominently to the front, for does it not seem an anomaly that railway companies should be obliged, not only in their own interest, but in that of the public, to construct their own iron and steel roads, while on the other hand road locomotives are allowed to traverse on, and to wear and tear the roads which others have not only made, but are compelled to maintain?

REMARKS AS TO THE RELATIVE COST OF MACADAMISED ROADS AND PAVED STREETS.

By JAMES HALL, C.E., BOROUGH SURVEYOR, STOCKTON.

The battle of the pavements has almost assumed as great proportions as the battle of the gauges did some years ago. Articles have appeared both in the professional journals, the serials, and the newspapers, written by both professional men and others.

It is only during the present century that engineers and surveyors have given the attention to road making that the subject deserves, yet at this day there is a great diversity of opinion among the members of our profession.

It is almost impossible to lay down any hard and fast line as to the material to be used over the whole kingdom, as different localities produce different descriptions of stone, all suitable, to a greater or lesser degree, as a road-making material, when used either as paving sets, random paviers, or road metal.

The writer proposes in the following remarks to give, in each instance, the original cost of the material.

In Stockton, the foundations of all roads and streets are formed of slag from the blast or puddling furnaces; this makes an excellent foundation, and when the grey slag is crushed to about 1½-inch cubes, makes excellent concrete. For ordinary thoroughfares the foundation is 13 inches thick, the lower layer being formed of hand penning, and covered with finer material. This foundation is used both for macadam roads and paved streets. The writer consolidates all his foundations with a plentiful supply of water and a 15-ton steam-roller.

The road metal generally used is blue whinstone, or sometimes a mixture of tough limestone and whinstone, laid 4 inches thick and thoroughly rolled; as a binding material, foundry loam or fine gravel is the best. The writer has tried both lime and cement as a binding material, but cannot recommend either as an economic success.

The cost of a good macadamised roadway in Stockton is 1s. 5d. per sup. yard, exclusive of foundation, which may generally be taken to cost 1s. 4d., raking in, rolling, &c., about 1d., in all 2s. 10d. The writer estimates the cost of broken metal to be 8s. per ton, and leading and spreading 2s. per ton. To repair an old road the cost cannot be estimated to be less than 1s. 2d. per square yard, exclusive of rolling, cleaning, and watering. The cost of maintaining a macadamised road has been found by the author to be from 9d. to 2s. 1½d. per sup. yard; in London some of the macadamised roads have cost as far as 3s. 7d. per yard to maintain per annum.

Roadways paved with whinstone sets cost about 6s. per square yard, inclusive of foundation, and their life can be safely put down at twenty-five years, that is for sets 4 inches broad, 5 inches deep, and of random lengths; the deeper the sets the longer the life. The writer finds that the deeper the sets the longer they last and the firmer job they make; another great advantage in using deep sets is, that they can be redressed on the face and used to pave secondary streets where the traffic is not very heavy.

The cost of ordinary street paving in my borough is 6s. per yard, and if taken up and relaid 1s. 6d., the cost spread over twenty-five years is only 3·6d. per yard per annum, after which period the value of the stones for road metal cannot be estimated at less than 1s. 8d. per yard.

Having thus briefly described the two methods of paving or road-making, it is proposed by the author to form the basis of the deductions he proposes to draw, in reviewing the relative cost of macadam roads versus paved streets, from the figures given. It must, however, be understood that in certain localities where the gradients are very severe the above prices or conditions would not be applicable.

Macadamised roads in towns have only one favourable feature, that is, their comparative noiselessness after being properly consolidated; but in dry weather the nuisance caused by the dust, and in wet weather by the dirt and sludge on the roadways, counterbalances the former advantage. Properly laid set pavement, on a good, even, and level foundation, should form, comparatively speaking, an almost noiseless roadway. The author strongly recommends that all black or random pavements should be well and properly grouted, so that the whole is formed into one solid mass.

Grouting prevents the wet from loosening the bedding on which the stones rest, and prevents the rocking which is so injurious to

every description of paving. The material to be used in grouting is generally either pitch, cement, lias lime, or common lime. The author finds that good hard burnt lime, mixed at about 1 in 3 with sharp sand or fine gravel, in a properly constructed grouting tub, is a most excellent material to be used.

The author has endeavoured to show that the cost of maintaining macadamised streets or roadways is considerably in excess of that of paved streets or roadways; and in conclusion would draw attention to a comparative statement as to the cost of cleansing and watering the two methods.

Macadam roads produce considerably more dust than paved roads, and therefore require more watering; but when a macadam road is thoroughly watered it retains its dampness for a period considerably longer than a paved street. It must also be remembered that every time a macadam road is thoroughly watered and subjected to heavy or continuous traffic, the surface is being injured; and in a thin road it will soon be found that, with regular watering during the summer months, the road is very seriously cut up, which renders temporary repairs necessary before the spring, that being the time when all macadam roads should be repaired if any repairs are required.

In a well used thoroughfare paved with sets it will be found that to cope with the dust it will be necessary to water such a street at least twice to the macadamised road once, because the hard surface of the pavement causes the sun to dry the water up very quickly.

Taking everything into consideration with reference to the comparative cost of the maintenance of macadamised roads and paved roads, the writer is firmly of opinion that the latter will be found to be the most economical and most satisfactory to any local authority or engineer who may be called upon to decide between one system and the other. The writer expresses his regret at not being able to illustrate his paper with tables, but must refer Members to the paper read by him at Blaydon-on-Tyne, February 25, 1881.

DISCUSSION.

The CHAIRMAN: As to the last paper, I shall be glad if each gentleman will give the results of his experience. It opens a wide field for argument, and I am very sorry indeed we have not Mr. Hall with us.

Mr. WHEELER: My experience is that roads paved with sets are infinitely preferable to macadamised roads for towns. Nearly the whole of Boston is paved, and the inhabitants prefer it to macadam. As to the watering, my experience is different from that of Mr. Hall; I find it requires much less water on paved roads than on macadamised. In Lynn, a well paved town, they use sets three by three, and they seem to stand very well indeed. One street leading to the docks has been paved four or five years and does not seem to have given way at all. My town being level, very heavy weights are put on the railway trollies. The sets are laid on lime concrete and grouted. In one place we have used pitch and found it much better. As to excessive traffic on highways I think the Act is very unsatisfactory. A road should be adapted to the traffic of the neighbourhood, and the later decisions of the judges have borne this out. It must be really extraordinary traffic to warrant the cost of repair being thrown on the person using the road. Supposing a contractor began building a railway and running a number of traction engines over a highway, that should be a ground for claim, but if it were the ordinary business of the neighbourhood I do not think one could come on the parties for damage. Of course there was a difficulty in determining what the damage was. The highway surveyor is only appointed for one year and can only send in a claim for one year, though the inhabitants might have to bear the result of the damage for several years. I would also suggest that each local authority should be allowed to make bye-laws, only subject to a central authority in London. I think different bye-laws should not be made by each local authority. Mr. Wheeler concluded his remarks in illustration of this by making a brief allusion to the taking of the great bell to London and the difficulty which had to be contended with in going through perhaps twenty districts, each with different bye-laws.

Mr. TUDOR: It was at my particular request that Mr. Hall wrote his paper, and I made the request in consequence of the

difficulty I have found in keeping my roads in repair. I endorse Mr. Wheeler's opinion as to the watering—it took much less water for a paved road than a macadamised one. I have thought for some time, in respect to Goole, that paved streets would be much less costly in the end. The whole of the streets do not belong to the Local Board. This portion of the town belongs to the Navigation, who have to keep the roads in repair. I have no doubt the Local Board, after taking over the streets, will pave them as soon as it can be afforded, but they have not had an opportunity of doing that, as other matters, such as the waterworks, demanded attention. I have had much experience in Manchester in street paving, and have no doubt that it is one of the best things that could be done for this district.

Mr. CROSS: Mr. Hall says that his cost was 6s. per yard. I do not understand it, as he could not get it done at that price. It cost me 6s. for the paving without foundation, so I think there must be some mistake. As to grouting I think there is nothing like pitch. Mr. Hall said twenty-five years was the life of whinstone sets. I do not know what traffic Mr. Hall has, but I should say in my town twelve years was the life. Whinstone is a very good stone, but it is not suitable for a town with any steep gradients. In a town like Goole I should say whinstone would do very well. I believe granite paving to be the cheapest in every way, but this again is very objectionable in a place with steep gradients. There is nothing like Yorkshire stone for steep gradients. In Dewsbury we have roads paved with Yorkshire stone, with gradients of about one in ten. I have never known a horse slip down on them. I cannot understand any town being done for 6s. per square yard unless they have the stone given them.

Mr. TAYLOR: It is a fact that macadamised roads are run down and paved roads strongly advocated, and very properly so; but I think you do not see in every place you go to macadamised roads made as good as they might be. In Barnsley we have tarred macadam, and the cost of it was 1s. 2d. I believe the life of that coated road would be four years, and some of those traversed by traction engines, and they do the most damage, would last two and a half years. The 15-ton steam roller was a great advantage. I am glad Mr. Tudor has explained to us that all the roads are not in the hands of the Local Board, for it strikes me they are not very good roads, but I hope when he gets them that he will make them good.

Mr. ESCOTT: I live in a hilly district, and we are never troubled, except at the midsummer fair, with the traction engine, and I have not seen any ill effects from it. I do not like to obstruct the traffic of a town or put any impediment in the way if they are rate-payers. I think every ratepayer should have the road kept in repair, so that he may take any traffic from one part of the town to another without being hampered or called on to a weighbridge as the Act stipulates. I have so far opposed, before the committee I have to do with, any interference with the heavy traffic, and it is, so far as I know at present, my intention to do so. I think if the roads are not fit to carry heavy traffic they ought to be made strong enough. If, however, the heavy traffic came from the stone quarries beyond the borough, or from Bradford or Leeds, they should make the parties pay their proportion for the maintenance of the roads over which they pass. No doubt Mr. Taylor keeps a street ledger. It is a great labour to do so, and you will find that it requires an extra assistant. Mr. Taylor lays great stress on the 15-ton roller, and I suppose he finds it answers exceedingly well; but I do not believe in it so much. I am trying, as far as I can, to reduce the length of macadamised roads by paved ones, and I do not see that a 15-ton roller is necessary to make a good road. As to the bye-laws, we have heard a great deal of this central authority, but I do not like it at all. I think we are quite capable of taking care of ourselves without having a central authority. Some allusion has been made to taking the great bell to London, but that is an exceptional case, and might easily be got over. As to the comparative noiselessness, it is quite impossible with a 30-foot road, and shops on both sides to make a noiseless road. If the road were 60 feet wide it might be different. I water macadamised roads as much as I can in the summer, in order to improve them and not to injure them.

Mr. GAMBLE: I should have liked to have heard more about the cost of the tar-macadam roads. I have seen them in Liverpool, but I think with tar at 2*l.* or 50*s.* and granite at 12*s.* a ton the metalling must be very expensive. About the 15-ton roller, of course the greater the traffic the heavier would be the roller required. I should think 12 tons would answer for most towns.

Mr. CROSS: I think the question of concreted and macadamised roads is an important question and not sufficiently gone into. I tried some time ago with granite and boiled tar. It was very similar to an ordinary road, and I found it would stand very heavy

traffic which would have cut up a macadamised road in no time. Traction engines injure paved roads much more than macadamised roads. I believe in a macadamised road, whatever the gradient may be, unless it is on a hill side, and there is nothing so noiseless except wooden pavements.

Mr. TUDOR: I do not think I ever saw roads in a worse condition than those of Goole were when I first came to it, but the Local Board when it was formed did the best it could to make them as good as possible. I quite agree with Mr. Taylor as to the steam roller: it is certainly a very useful thing for a local board to have; it gives firmness to the road.

Mr. WHEELER asked Mr. Taylor if he used the gas-tar from the gas-works.

Mr. TAYLOR: We have until just lately, and now we use only pitch and oil, and I believe it is much better.

Mr. WHITLOW: My opinion is that paved roads are very much superior to macadamised roads. As to the life of the road being twenty-five years, I think about one-half that time is sufficient. I think with Mr. Taylor the Highways Amended Act is altogether uncalled for, because roads ought to be made sufficiently strong to bear the traffic, and it is unjust that contractors should be called up by this or that surveyor for this and that sum of money. As to the suggested amendments to the Act I think there is already too much tapeism. Local boards and corporations are quite capable of dealing with the matters under their supervision better than any authority in London.

The CHAIRMAN: We have had two papers, one on the construction and the other relating somewhat to the destruction of roads. I will first refer to the one on the construction of roads, and which appeared to give rise to a considerable diversity of opinion, and I agree in many instances with the remarks made by the previous speakers. It would have been much better had the author of the paper given us the basis of the formation or foundation of the road. Allusion has been made to a plentiful supply of water and the 15-ton steam roller. My experience is that this is the most suitable size, that no road can be made without a roller and that it is not necessary to have a heavier one. Liverpool appears to be of this opinion; for with a heavier roller they broke their gas and water mains and they were glad to return to the smaller one. Coming to the point relating to macadam, a very proper suggestion has been made by Mr. Taylor as to increasing the life of macadam by

the application of tar. In Birkenhead, Mr. Thorburn, a Member of this Association, constructed the chief roads with a tar surface, but such a road would not be suitable for Leamington, as it would destroy the carriage-wheels, but I think you must all agree that macadam would stand better with pitch and oil properly applied. In Birmingham it seems to be a standing rule that if a road requires dressing more than twice in the year it is cheapest to pave it, the paving adopted being somewhat similar to that used in Liverpool and Manchester. A very strong assertion has been made and one I cannot endorse with reference to paving, "We have a perfect or almost noiseless roadway." That is impossible with a granite pavement. The fact of its being rough prevented it. The nearest approach to a wood pavement that I know of is slag, which forms a perfectly smooth pavement with joints for the foothold of horses. If you get a polished granite pavement it will be nearly noiseless, with the exception of the tramp of the horses. We have a statement, the greater the depth of the pavement the greater the life of the road; but with that I cannot agree. My experience is that six inches of concrete and five inches of pavement will last far better than a nine-inch pavement of stone without the concrete. As to watering the roads I did not think Mr. Hall ever intended that the water was put on except to prevent the dust from rising and keep the stones from getting loose. Water is an absolute necessity to keep the stones in a proper position, and to keep down that abominable nuisance of dust from flying all over the place. A most important question was raised by the paper read by Mr. Taylor. At the present moment steam traction engines are becoming very general, and every provision should be made for them, but at the same time I do not think we should have the roads destroyed because engineers will not construct the engines in a proper form, and therefore, whilst engineers call upon public bodies to give them proper roads, we must call on those gentlemen who could do with one engine instead of twenty horses, to give us all the construction possible so as not to destroy the road. I do not go the whole way to say we should punish or prosecute them, but I say we should get them to alter the construction of the tires of the wheels so as not to destroy the roads. I would like to ask why it is necessary to have a greater pressure for a two miles velocity than for four miles.

Mr. TAYLOR, in replying, said one matter Mr. Wheeler referred to was roads permanently damaged; although they might recover

damages the first year they did not cover the damages incurred in future years. He thought they would have to leave that. If according to that Act they could get the cost for extraordinary traffic, as appeared after the damage was done, they would have to be contented. As to the bye-laws, he dared to say it was superfluous to put that in because, as they were aware, the local board's bye-laws must be confirmed by the Local Government Board, and with a corporation by the Home Secretary, so that they had that now. As to the street ledger he would suggest that, to get over that difficulty, Section 23 should be amended so that the charge for extraordinary traffic should be 1*d.* per ton for macadamised roads. He was glad they agreed with him that traction engines did more damage to paved roads than macadamised. As to the steam roller, the 15-ton one was in his judgment the most useful. As to the question put by Mr. Pritchard, a maker said if he wanted to go at a low velocity with a traction engine he must have a greater pressure than if he went at a higher velocity, and therefore to save steam he went at a higher velocity. (Mr. WHEELER—There is less friction.) Less friction. (And the net result would be better.) He was looking at it from a road maker's view.

The CHAIRMAN said he should rather take the view of the maker of the engine. The action of the piston could not in any way possibly affect the destruction or otherwise of the road because it was working by gearing to the wheels. He then proposed that the best thanks of the meeting be given to Mr. Taylor and forwarded to Mr. Hall for the papers they had supplied them with.

Mr. WHEELER seconded the motion, and it was carried.

The Members then proceeded to inspect the hydraulic coal boat lift, the North Eastern Railway hydraulic swing bridge over the river Ouse, and the new dock of the Aire and Calder Navigation, now in course of construction, permission to view having been given by the authorities. Great interest was taken in these, particularly the swing bridge, which weighs 800 tons, and was opened and closed and the working thoroughly explained by Mr. Armstrong. The water tower, now in course of erection, connected with the town water supply was also inspected.

ANNUAL MEETING IN LONDON,

June 29, 30, and July 1, 1882.



ADDRESS OF THE PRESIDENT,

CHARLES JONES, Assoc. Inst. C.E., Local Board, Ealing.

GENTLEMEN,—It is with very much pleasure I meet you at this our General Annual Meeting. The unexpected honour you have done me in electing me to fill the Presidential Chair during the present year is one for which I cannot express myself in adequate terms. As your Hon. General Secretary since the formation of the Society, I have been rewarded year by year in the growing usefulness and importance of our Association, little dreaming that you would by so unanimous a vote call upon me to fill a position which has hitherto been filled by gentlemen holding the highest appointments amongst the municipal corporations of England. To follow such is no easy task. At the same time I may express a hope that when my year of office comes to a close, the verdict of my professional brethren will be at least, that we have done what we could to advance the best interests of the Association of Municipal and Sanitary Engineers and Surveyors.

The duty which now devolves upon me of delivering to you an Inaugural Address, is one which I would fain have avoided if possible. Doubtless each of my predecessors has felt somewhat the same, and the difficulty will, I take it, increase as the Association grows in years. Not that there is a lack of topics upon which to touch, but from the fact that many of these topics have been so well treated by those who have gone before. I cannot but feel, however, that having held office amongst you since the formation of the Association, it will be only natural that I should say a few words upon the Association itself. We remember the occasion when, at the invitation of our esteemed friend Mr. Lewis Angell, we met at the Council Chamber of the Institute of Civil Engineers, to

advise with one another upon the position in which the engineer and surveyor, holding appointments under the Public Health Act, were placed by the existing laws of the country. That conference, as you are aware, led to an interview with the then President of the Local Government Board. He admitted the justice of our statements, but at the same time expressed his doubts as to the probability of any alteration being made, grounding his opinion upon the fact, that although the position of engineers under the Public Health Act was one of the greatest importance, and although many of them were Members or Associates of the Institute of Civil Engineers, the fact that they were not in themselves a representative body, a "concrete mass," was very much against them. To this expression may be attributed, to some extent, the formation of our Association. We immediately held a meeting, and decided that we would remove this objection, and that henceforth the Municipal and Sanitary Engineers of England and Wales, working under the provisions of the Public Health Act, should become a "concrete mass." The history of the Association from that time has been one of gradual but substantial growth. Some few amongst the larger towns looked with doubt upon the movement, and for a time held aloof, but to-day we have the satisfaction of knowing that hardly a town in England of any note, but its engineer is enrolled amongst our Members. And the fact that West Ham, Liverpool, Manchester, Birmingham, Bristol, and other important towns have supplied us with Presidents, suffices to mark our position and our progress.

That much remains to be done must be evident to all those who have any knowledge of the subject. In England and Wales the urban authorities number nearly one thousand, and it would be well if every one through their engineer or surveyor were connected with us; this, however, is not the case, although as you have heard from the Report read, our progress is most satisfactory; nor can anyone for a moment ignore the fact, which is patent to the mind of every Member, of the advantages which of necessity arise from co-operation and mutual support. The meetings which have been held in various parts of England have been the means of bringing together, with one common object, men who, but for these meetings, would have been strangers to one another, working on in their own little circle, missing that interchange of thought and feeling which has tended so much to develop resources which but for this interchange of ideas would have lain dormant and unused. In years that have gone by, much has been said and written with respect to

the position of the engineers and surveyors, under the Public Health Act, in both the social and scientific point of view. The correspondence which passed between our first President and hundreds of men holding positions under the Public Health Act led us to realise in a painful manner the strange and unseemly difference which existed between men appointed to carry out the same class of work, and having the same responsibilities, although in a varied degree; and the fact stared us boldly in the face, that while there were many whose position was one of credit and respect, there were hundreds who were the mere nominees or tools of interested sections in their several towns, and whose position was one we hardly cared to contemplate; who, instead of being the exponents of an Act passed for the benefit of the public at large, were unable to carry out either the letter or the spirit of the Act whose officers they were supposed to be. The construction of numerous local boards was such that many of the men elected to hold positions as members were sent there not to carry out the Act, but to be a check upon its working, and woe be to the man who had the courage to be firm, and who dared to carry out honestly the provisions of a law which they were there to obstruct and oppose. Details were supplied to us which proved beyond the shadow of a doubt that such cases existed, and that not only in little out-of-the-way places far removed from observation or official notice, but in towns of great and growing importance. Within the last few weeks even we have had an unseemly—shall I say disgraceful—illustration of what I have referred to. A gentleman holding a position in an important and rapidly increasing town takes proceedings, as he was bound to do, against one of those monstrosities of modern civilisation “a jerry builder,” for using mud instead of mortar, and rubbish instead of sound material, and we find—what? I am almost ashamed to state it—we find two members of his own Works Committee giving evidence in favour of the criminal, and against their own officer. I need hardly say he gained his case. The criminal *was* convicted and the surveyor goes back to his work with the happy consciousness of having done his duty, *but*, at the same time, with the knowledge of the other fact, that he has made, it may be, two bitter enemies, who will probably leave no stone unturned to render his position irksome and unpleasant.

It would be impossible, not to say unwise, to touch more fully, within the limits of an Inaugural Address, upon the many points which naturally spring up in connection with the subject

now touched upon. It is possible that in time to come the position of the local board engineer and surveyor may assume more of that character which appertains to a surveyor under the Metropolitan Building Act, and his appointment having been made, a power of appeal shall be given to the Local Government Board, or to some court of jurisdiction established by Act of Parliament. The effect of this would be at once to make the surveyor free from the possibility of such influences as those to which we have referred in the case cited, while at the same time it would ensure the important post of local board surveyor being filled by men who have had a training for the office they seek to occupy, but which in many of the outlying districts of England and Wales is looked upon as just the place which admirably suits the squire's worn-out gardener, the ex-parish constable, or some military hero, who, having served his country for seven or fourteen years, is considered duly qualified to perform the duties set forth in the Public Health Act, the addition to his pension of the extravagant sum of 25*l.* a year being considered by the economists of his town an ample remuneration. We indulge the hope that the time is coming when these things will be of "the past"; and without fear of a charge of egotism being laid against us, we do feel that as an Association we have done and are doing our best to alter this state of things.

It will not be inconsistent with these remarks to look for a moment at the varied subjects which occupy more or less the attention of the engineer and surveyor under the Public Health Act, and upon which he is bound to advise his board. As an engineer he must be acquainted with the various matters connected with sanitary engineering, and have some knowledge of the machinery placed in his charge. As an architect and surveyor he must have a considerable acquaintance with that particular department, in order not only to advise and report upon the various plans submitted for approval, but also to design and carry on such works as may be required of him for the public purposes of his district. As a practical chemist he will find ample scope for the application of something more than its first simple principles. Upon the lighting of his town with gas or the last new medium, electricity, he is expected to be an authority, and the question of water supply must not be an unknown subject. The sewage farm in its varied operations will fill up his spare moments, and the value of materials, and the construction and maintenance of roads,

both main and suburban, will, of course, be subjects with which he is perfectly at home. To these may be added some half dozen other items to make up the total required as the fitting acquirements of the local board engineer and surveyor; in fact, he must be in the fullest sense of the word "an all-round man." And, gentlemen, you know that this is no flight of fancy, but a stern reality, which comes home to most of us; and perhaps I may be allowed to say that I can give no better illustration of the officer I have described than our late esteemed president, Mr. Morant, who—taken from us in the very prime of life—has left us an example of a model municipal officer, which we may well seek to emulate.

Upon the question which has been so often discussed—that of enforced examination—I believe there is but little difference of opinion existing amongst us; but we do hold that such an examination should be in the hands of the only representative and chartered body in the country, as representing the engineers at large, namely, "The Institute of Civil Engineers."

If the requirements of the office are in any degree what I have pointed out, surely the fitness of any man for such a post is not to be based upon his ability to answer a dozen questions, such as the following, which form the last Examination Papers of the Sanitary Institute.

"EXAMINATION OF SURVEYORS—PAPER 1.—2 TO 4 P.M.

"1. State the principal provisions of the Public Health Act of 1875. Is it applicable to the whole country? Has it been modified by subsequent legislation, and if so, how?

"2. Give the substance of the model bye-laws issued by the Local Government Board, regulating the construction and management of slaughter-houses.

"3. A twelve-inch pipe sewer is running half full, and the sewage has a velocity of three feet per second; how many gallons will be discharged per minute? Also, how many gallons per minute will be discharged from a six-inch pipe drain under the same conditions? Give your calculations in full.

"4. Describe and give a sketch of the form of man-hole which you consider best adapted for ordinary town sewers, and state the rule which you adopt for determining the amount of ventilation to be afforded in a main street sewer.

"5. Describe (with diagram) three typical forms of disconnecting traps for drains, and explain their action.

"6. What are the chief points to be looked at in order to determine whether a water-closet is satisfactory from a sanitary point of view? Illustrate your answer by sketches.

"PAPER 2.—6 TO 8 P.M.

"1. What is an artesian well? Under what circumstances would you advise the construction of such a well?

"2. How is drinking water most likely to become polluted—(a) in a town with a public water supply? or (b) in a rural district? What precautions would you take in each case to prevent the pollution?

"3. What circumstances favour the entrance of "ground air" into a building? Why is it necessary to exclude it, and what are the principal modes of doing so?

"4. Give a clear and concise definition of good ventilation, stating how much air is required per head per hour.

"5. Sketch plan and section of a hospital ward and its offices for twelve patients, and state how you would propose to ventilate it.

"6. Sketch sections of roadways constructed of different materials, and state the advantages and disadvantages of each."

With many of us, years of office work had to be gone through before it fell to our lot to hold independent positions, and years of official work only go to demonstrate the necessity of a thorough practical training, and the inconsistency of a course which enables any one with a slight smattering of the various subjects, a good memory, and a little friendly coaching, to go into the arena of public office life, armed with a certificate of qualification, whose principal merit is its artistic appearance, and its prettiness when framed and glazed and decorating the official walls of its proud possessor.

Take the district surveyors of London, working under the Metropolitan Building Act. I think I should be perfectly correct in saying that not one, from the first creation of the office to the present date, but served his time to a professional man, and for many years past the candidate for office has had to pass an examination at the Institute of British Architects, of such a character that only years of practical work would fit him to cope with. Take the medical profession, with which we are brought into intimate acquaintance through our medical officers; here again we find years of work and careful training are required before the simplest

examination could be attempted which should give a "status" as a medical man. I might pursue the subject, but refrain from doing so; suffice that I have given utterance to a word or two which I trust may lead to thoughtful action and beneficial results. At the same time I most sincerely disclaim any feeling of antagonism against the Sanitary Institute. I have the pleasure of knowing and esteeming many of the gentlemen connected with it, and I only regret that, upon this particular question, the course pursued is one with which, as a body of municipal officers, we cannot agree.

Amongst the many questions still agitating not only the minds of the sanitary engineer and the medical man, but also very largely the public mind, is the long-discussed difficulty of sewer ventilation. From the period, some twenty-five years since, when a leading medical journal refused the paper of a well-known member of the medical profession, who, stepping out of the strict limit of his professional work, addressed his attention to a then almost novel subject, and was informed "that the question of sewer ventilation and the necessity for continuous flushing of sewers which he then advocated, were questions to be settled by engineers, and *not* subjects for discussion in medical journals," down to a few weeks since, when articles of the deepest interest, and which must commend themselves to the minds of every sanitary engineer as well as to the *medical man*, were given forth to the public in the pages of the same leading medical journal; we say during this period probably no question with which sanitarians have had to do has been so fully discussed, or has been the subject of so much difference of opinion. On the one hand we have those who have advocated the sewer entirely closed, on the other hand the importance of opening up as widely as possible into the public road. One authority advised the use of the public lamp-post as a means of ventilation, while another propounds the oft-repeated theory that shafts and furnaces can be the only means of dealing with the difficulty. One authority proves without a doubt that sewage gas was a potent element in the production of typhoid fever, while another equally important authority proves, at any rate to his own satisfaction, that it has nothing whatever to do with it.

Scientific authorities base some theories of ventilation upon the fact that the air current of every sewer is upward, and against the stream. A well-known foreign experimentalist has within the last few months sought to prove by a series of interesting experiments

that this is not the case, but the current travels with the stream. These varied principles to a great extent are and must be controlled by the peculiar circumstances and physical characteristics of each particular district, the size of the sewers, the widths of the roads; even the fact of the houses on either side of the roads being detached, semi-detached, or in terraces, with varied other circumstances, must all tell upon the question. One thing, however, is certain, and without the shadow of a doubt, that stagnation in a sewer means disease and death, whilst a rapid atmospheric current with systematic flushing minimises, if it does not absolutely remedy the evil.

Again, the subject of systematic sewer flushing brings up another question upon which a variety of opinions must of necessity exist. Only a few weeks since I noticed in the public press a short abstract of a lecture on sanitary matters by an eminent sanitarian, one who has done an immensity of good by the labour he has bestowed on this particular subject. In this abstract, however, he touched upon the separate system or separate sewers for rain water and sewage, and laid down as an absolute theory, that under no circumstances whatever should rain water be allowed to pass into the public sewer. A theory more opposed to the first principles of sanitation, I can hardly conceive of; for strongly as I am in favour of that which we know as the separate system, or, as I would understand it, a separate sewer for carrying off the immense amount of water that falls upon our public roads, and so relieving the main sewers of an unnecessary burden, to say nothing of the "detritus" of the roads, which will to some extent be washed into them, and help to block the free current of the sewage, I know of nothing which tends more to the purification of the immense quantities of lateral drains which appertain to the several properties which lie along the line of our main sewers, than the heavy flush of rain, which, dealing with drains over which the sanitary engineer or local surveyor has no control, carries on a purifying process which no mechanical flushing can by any possibility produce. In our "main sewers" we can deal with the difficulty, but not in the house drains; and only those who like ourselves have daily, and it may be for years, dealt with the subject, know the immense difficulty there is in leading householders to care for themselves, or take the slightest interest in the sanitary difficulties of their own homes. I estimate that for every mile of main sewer passing down a road of say 50 feet wide, and

with semi-detached villas on either side, there is at least 4 miles of lateral drains, and it is in these that too often difficulty arises, the only remedy for which is the kindly assistance which nature gives us in the purifying influence of a heavy rain.

Again referring to the articles in a leading medical journal, which I have read with such deep interest, and from which I have gathered much useful information, I can only express regret that the tone of the remarks is such as would tend to sever the kindly feeling which should exist between two professions whose common object should be, and is, the working out to a satisfactory result a great public question, and who by their enforced association under one governmental department, should ever be found working hand in hand together. In closing these remarks upon this particular branch of the sanitary question, I cannot forbear calling the attention of my brethren to a work which may be already known to Members; if not, it is one which I would myself recommend, namely 'The Pictorial Guide to Domestic Sanitary Defects,' by J. Pridgen Teale, M.A., a medical gentleman, who deserves the thanks of every earnest sanitarian in England, and whose work should be in the hands of every medical man and sanitary engineer. The defects there depicted, in what one might almost term a semi-ludicrous style, and in which it may be said there is nothing particularly new, are so cleverly and truthfully drawn as to convey simple yet most important truths to the mind, and strike at the root of many a serious evil which lurks about our homes. In its own simple manner, it teaches lessons far more valuable than cart-loads of semi-scientific lectures, which but too often are valued from the fact that they must be clever because they are so abstruse and so far beyond the power of busy mortals to understand.

Another subject which naturally affects the Members of this Association, and which has again and again been treated of, is the effective carrying out of the bye-laws which have been framed in the various urban districts appertaining to the proper construction of roads and buildings. I have no desire to enter largely into this subject, but would rather touch upon it, hoping that upon this occasion the customary rule of not discussing an Inaugural Address may be set aside, and the opportunity may be afforded to those present of expressing an opinion upon the points referred to. This question of bye-laws, as you are aware, has of necessity and very properly come to the front, in connection with the express

desire of the Government that local boards should adopt in their several districts the series that lately emanated from the Local Government Board, and known as the "Model Bye-laws." Probably no question has been discussed during the last four years more fully by us, as an Association, than these model bye-laws. The experience of many years has been brought to bear upon them by many of our members, and more particularly it may be by some of us who, trained within the limits of the metropolis, governed by the Metropolis Local Management Act and the Metropolitan Building Act, have brought, it may be, a somewhat critical judgment to bear upon them. The one great defect probably was the fact, that absolute laws were made to apply under *every* circumstance to *every* place. The square peg must fit into the round hole, whether it would or no. I cannot help thinking, however, that at the present time there is a disposition to meet the peculiarities of different districts, while at the same time making the bye-laws absolute and not permissive when once they have passed the Local Government department. For depend upon it, it may be taken as a sound rule, based upon large experience, that building "bye-laws," which are permissive in their character, are worse than nothing. With a permissive bye-law the "jerry builder" will move heaven and earth, and become the patron saint of everything that is good and benevolent, if thereby he can but find a seat for himself or his nominee at the local board, and put his veto upon the carrying out of an Act of Parliament which interferes with his scamping building; but if the bye-laws are absolute no interference of his can by any possibility affect them.

For the past two years these model bye-laws, with certain amendments as agreed to by the Local Government Board, have been carried out in my own district, and I feel bound to confess that the advantage accruing therefrom has been very great. Of late I have seen this more particularly shown in the power it has given us in dealing to a considerable extent, with those curses of suburban districts, the "land societies," a class of speculators of whom I must confess I have the greatest horror, and for whom no law can be too stringent; whose only object is to cut up an acre of land into the smallest possible pieces, and to crowd upon it the maximum number of houses that the law in its weakness allows. There is one point, however, in connection with the Act, to which I feel bound to call attention, although it is one which has been so ably dealt with by our friend Mr. Lewis Angell in a paper read

by him some years since ; I refer to the subject of the payment of fees by builders, for supervision. Admirable as are the model bye-laws, I believe one of the principal impediments in the way of their general introduction is the fact that they necessitate special and systematic supervision for the carrying of them out. In a town or a district of any importance the immediate requirement is a proper staff, more or less according to the necessities of the place. Unless this is provided, the adoption of the model bye-laws throws an amount of work upon the official altogether beyond his power of dealing with, and the board, naturally anxious to avoid an increase of staff and its corresponding expenses, settles the difficulty by a non-adoption of laws which, while beneficial in themselves, would necessitate an increased expenditure. The men who *don't want inspection* raise their voices against them, and the ratepayers as a body are too often led by the men whose voices are the loudest, or their arguments the most specious, notwithstanding that the said arguments when weighed in the balance of common sense are found awfully wanting. This difficulty would at once be overcome by that which appears to me to be the most reasonable of all payments required under the Act. The plan is adopted in many of the larger provincial towns, under their own private Acts. It has been carried out for many years in London, under the provisions of the Metropolitan Building Act. Eastbourne, under the very Act which we work, has been allowed by Government a schedule of fees, and I am happy here to state that West Ham also, by the persistent energy of our late President, Mr. Lewis Angell, has during the present session obtained this important concession also. These fees, small in themselves, not large enough to be taken into consideration when compared with the cost of the erection to which they apply, would still in the aggregate form a fund in the hands of each local board sufficient to warrant them in providing the necessary supervision for carrying out these essential bye-laws, without imposing an additional burden on their ratepayers. And here I would quote a few words from Mr. Angell's paper on the sanitary supervision of dwellings. He there says :—" . . . Why, therefore, should they (the builders) not contribute a fee, small in itself but large in the aggregate, to provide the supervising staff which their pursuit of fortune necessitates ? Because, we are told, they are already adding to the rateable value of the town ; but, as a matter of fact, such increase of buildings does not lessen the general rates, inasmuch as it involves a proportionate increase in the maintenance of roads,

sewers, lighting, scavenging, police, &c., not to mention the increase of poor-rates generally attending on the increase of a population.”*

With these remarks I leave the topic, hoping that ere long some independent Member of the House will introduce it amongst the clauses of some modification of the Public Health Act which may be brought before Parliament, and to which I feel assured there will be no opposition by the Local Government Board, although they will not themselves introduce it. I fear that I have already tired you by the length of my remarks. I would fain have touched upon the question of sanitary legislation, or I might say, non-sanitary legislation of the past and present session, and of decisions that have been made in the Law Courts. I would have looked into the question of “may” and “shall,” as involved in a late decision of the Master of the Rolls. I might have touched upon the best means of lighting up our highways and byeways, and other equally interesting subjects; fortunately, however, these matters will be dealt with by some amongst us who, having given their special attention to these questions, are far more capable of dealing with them satisfactorily than I am. And in concluding this address, I would express an earnest desire that every Member of this Association may, in the multifarious duties which fall to his lot, be enabled to carry out those duties devoid of fear, and seeking no favour, and realise in his individual position the same satisfaction in his work and the same support and consideration as the writer of this address can testify to, after a continuous official service in the same district of just twenty years.

DISCUSSION.

Mr. LEMON: Gentlemen, I have now very much pleasure in moving a cordial vote of thanks to our President for the address. He very kindly has asked us to criticise it. In the ordinary manner of our proceedings we should be out of order in doing so; but in this case our President invites it. He has alluded to many subjects which I will not detain you to travel over; but I will simply confine myself to those questions which I think are to our benefit in the future. The interest of this Association and the position which we occupy as surveyors, I think, is one of the first importance.

* “It was only last week that the Master of the Rolls, in giving judgment in a certain case, said, among other caustic remarks, ‘We are not to sacrifice the interests of the public to the interests of the speculative builder.’”

I was one of those who responded to the invitation of our friend and first President, Mr. Lewis Angell, to form this Association, and I have been intimately acquainted with the ups and downs of this Association from the commencement. The circular that was sent out to the Members—I dare say there are many of the younger members of the profession who never saw it, but if not I should very much wish that they could read it—a list of sorrows and penalties and difficulties I should think never was put before an Association equal to it. It appears from that list that those who did their duty most efficiently were the objects of the most persecution. In fact, I may say, that, if a local surveyor were simply to remain passive and do as little as possible, he could get on exceedingly well; but directly he becomes energetic, he then raises up a score of enemies. We have had an illustration in the address of our President of that fact. I may say I have had rather a bitter experience myself. That brings me to the question that the President has placed before us, whether protection is necessary for the officers of local boards. I have heard it stated by gentlemen holding high positions—I may mention one, Mr. Rawlinson—he says, when a surveyor cannot get on with a board, the very best thing he can do is to part. I may say in answer to that, that many annoyances to which a local officer is subject would not arise if the members of a corporation or local board knew that there was an appeal to a superior authority. Well, we have got precedent for that. For instance, there is the Poor Law. The Poor Law officers have the right to appeal to the Poor Law Board—the Local Government Board now—and may not be removed without the consent of the Local Government Board. I know, in one or two cases, that has had the very best effect, and that the officers under the Poor Law hold a more permanent position, and are more secure from personal attacks, than officers—surveyors—of local authorities. Well, then again, we have the medical officers. The medical officers are, as you know,—where the Local Government Board pay half the salary—protected as I think they ought to be. And I hope that this Association will not rest until it secures that very necessary protection to local surveyors. I think I may say it was one of the first objects which brought about the formation of this Association, and I think it is one of the objects which never ought to be neglected till we obtain our final triumph. The President has alluded to the bye-laws; I should like to say a few words with

reference to that. I think with him that the bye-laws should certainly be absolute and not permissive. In the Local Government Act the word "may" runs pretty nearly all through it. When the bye-laws are permissive, the practical result is that very little is done. I would go further, and say that the duty of taking proceedings against any one who infringes the Act of Parliament or the bye-laws, should rest with the officer of that department only. I think it is radically wrong that when a builder, for instance, infringes a bye-law, that the officer has to bring the case before his committee, and take instructions from that committee whether he shall take proceedings against the man who is making default. I have known cases where an officer has had to take the instructions of his committee when a member of that committee has been in fault. I should like to know under such circumstances, how a local surveyor is going to carry out his duties properly. In fact, he cannot do so. If he does, he makes a most bitter enemy, and it finally ends, perhaps, in his having to give up his appointment. But if a committee had no control over him, and it rested upon him to take action independently of his corporation, then I think the difficulties would not arise. Now we have a precedent for that in the position held by the district surveyors of London. I am a native of London, and have had to do with the working of the Building Act; and I know the advantages which result from the working of that Act being vested in the district surveyors themselves, and not in any local board, or in the Metropolitan Board. The district surveyor takes proceedings on his own authority; he has not to consult anybody; and he is to a certain extent independent of the body who appoint him. He is paid by fees, and these fees are paid to him direct. I think it is a right principle that a builder should pay fees, but to the local authority and not to the surveyor, because I think it is a mistake that any money transactions should take place between a surveyor and a builder. I do not mean to say that the surveyor would not act straightforwardly and honestly in the matter; but there is an objection to any of these little transactions going on between—the culprit, you may say, and the man who has to look after him. Therefore it would be better, if the Local Government Board agree to make it a general law that fees should be charged for buildings throughout the kingdom, that these fees should be paid to the local authority. With reference to that matter I may add that the difficulties I have had in carrying out

the bye-laws have been chiefly in the want of a proper staff. Now, I framed some bye-laws some years ago which are very similar to the present model bye-laws. Therefore, I may say, without wishing to sound my own trumpet in that matter, that I was perhaps a little in advance. But I found that the bye-laws were not workable, simply because the Corporation would not supply me with the necessary staff. I got a bye-law under which it was my duty to give a certificate that a house was completed in accordance with the bye-laws. I have never given that certificate, and never would, because I never could get my Corporation to give me sufficient assistance to see that all the bye-laws were properly carried out by the builders; and as I had no proof to satisfy me that the bye-laws were properly carried out, I refused to give a certificate, in the hope that the Corporation would give me the staff. They never did, and I never gave the certificate. I mention that as one of the subjects we have under consideration, and one of the results which would accrue if fees were empowered to be collected by local authorities. I have very much pleasure in moving a most cordial vote of thanks to our friend, Mr. Jones, whom I am very pleased indeed, as one of the earliest Members of this Association, to see in the chair on this occasion.

Mr. ANGELL: I have pleasure in seconding this vote of thanks. Ever since the formation of the Association, eleven years ago, I have had the most able assistance from Mr. Jones; we have worked together most harmoniously, without exception and continuously. Therefore I am very pleased indeed to find that he occupies the position to which we have elected him. I do not propose to follow at any length the discussion upon the matters raised in Mr. Jones' paper, because I think we shall be rather trenching on the paper by Mr. Jerram on "Sanitary Legislation." He has spoken of the condition of officers; the condition in which some officers still remain, I suppose, in some of the smaller towns, where ex-soldiers and men of that class fill the office of surveyor. Those places must be very small; but when this Association commenced, there were some very deplorable illustrations of the way in which the offices were filled. However, a great change has taken place in that respect, and the public are more awake to the necessity for sanitary work. The public are better educated, and they have found the necessity of employing better men, and now in our larger towns we have qualified men who are fairly paid—certainly very much better paid than when this Association com-

menced its operations. There is one name the President omitted of those who have passed away, that of Mr. Greator, of Portsmouth, who was one of the very first who joined us. I will just take this opportunity of noticing a remark which Mr. Lemon made, that the fees should be paid to the board, and not to the officer; I cordially agree with him. The principle of paying fees to officers is not a good one, and I carefully avoided that in the Bill we have just succeeded in carrying through Parliament. The fees are to be paid to the Local Board. We have not yet, at West Ham, adopted the model bye-laws, though they have been very much urged upon us. Of course we are a very large district, and the officers of the Local Government Board did not very much like the idea of our Board refusing to adopt them. But we gave them a direct answer, that they imposed so much work upon us that, unless the Local Government Board provided the staff, it would be unwise to adopt rules that it would be impossible to carry out without a large staff; and we all know that corporations and local boards will not provide the surveyor with a large staff. In my own Act we have a clause enabling the Board to appoint not more than ten building inspectors, and also limiting the salaries of the officers to 200*l.* per annum. Of course, we shall immediately proceed to appoint a number of inspectors, and I hope to be able to carry out the bye-laws in West Ham efficiently, and I may almost say more efficiently, from the assistance I shall derive from building inspectors, than it is possible to do elsewhere. As to the subject of certificates, that was included generally in the bye-laws of the country; but it was ruled, some considerable time since, to be *ultra vires*. There is nothing in the Public Health Act which gives you power to impose a certificate on builders or owners of houses. I never have given a certificate; I never would. I think it is rather a dangerous thing to do, because bad work may be covered up, especially with the want of supervision; you believe the thing to be all right; something goes very far wrong, and the certificate is flaunted in your face afterwards. Besides that, I found that a certificate was used to get advances of money. But, at all events, it is *ultra vires*; there is nothing in the Act enabling a local board to give certificates. I cordially second the vote of thanks to our President, Mr. Jones.

Mr. LOBLEY: In rising to support the vote, I do not wish to offer any criticisms on the address, but I should like to say a word

or two endorsing a few observations which have been made. I was very pleased to find a representative of the south of England, Mr. Jones, our President, not quite so firm in the modern gospel of the separate system. I was exceedingly pleased to find that he gave very good reasons for a single system of sewers to a certain extent. In the north of England very few towns carry out the separate system. I know in my own case—although I believe in the separate system up to a certain point as being exceedingly useful to carry off the surface water after heavy rains, and in many respects, as an addition to the ordinary system of sewers in the thickly populated parts of towns—I would have very great hesitation indeed in passing the rain water—the washing of the street channels—to the river. Of course I am alluding to the rivers near their source, not to those more fortunately situated near the sea. In large towns, and particularly towns that have an Irish quarter, it would be impossible to keep the slops out of the channel. Dirty water would be washed down the street channels. You say, provide them with good drainage in the yards. But they will not use it, and it will be many years before they are educated up to the point of ceasing to use the street channels as they have always done. The consequence would be that this dirty water would run down, and is in many cases quite unfit to be admitted into the rivers. The growing tendency of modern times, principally in the south of England, is to the separate system—absolute as far as possible. I believe Mr. Parry will tell us that he carries it out absolutely. I should be very glad if Mr. Parry can some time afford us an analysis of the water poured into the river from the rain-water drainage. My own impression is it would not, in my district, be found to be simply rain water. My experience is, that we can turn out a better effluent in dry weather than in wet; in spite of the fact that in wet weather the dilution is great, yet still the amount of detritus washed off the roads seems to be of such a nature as to cloud the water and make it more difficult to clarify. I am very pleased that our President has alluded to the advantages of the single system; as to flushing out especially. I believe that those having practical duties to carry out as town surveyors will agree that the value of rain water in cleansing the drains is very great, and should not be thrown away. I will not detain the meeting with regard to the model bye-laws, because they may come up on a paper to-morrow. Unfortunately, I have not

been able to do as Mr. Lemon and Mr. Angell have said—refuse a certificate. I found certificates given, and was obliged to carry it out; but I agree with them that it is mischievous. I have added a few words to my certificate, “as far as I can ascertain.” But I am afraid that does not have much value. But I do not think, however many inspectors Mr. Angell may have, he will be able to see every pipe laid. According to the bye-laws, every pipe must be seen before it is covered up. I think it would be better if we could have some legislation which would put the whole system of drainage into the hands of the local board to construct, and whenever it was found, in the course of time, that it was badly done, of course that would be a bad mark against the contractor employed. Until the surveyor has the laying of drains, we shall have bad drainage. But as soon as it is put entirely into the hands of local authorities to lay the drainage themselves, either by their own men or by authorised contractors, I think that will be a step in advance. I beg to support the motion of thanks to our President.

Mr. GORDON: I rise to cordially support the motion which has been moved and seconded by Mr. Lemon and Mr. Angell. You, sir, have invited discussion on the address which you have just delivered. I do not know whether that has been the practice in the past or not, but I am quite sure if it has not been so that it would be exceedingly well if the initiative were taken; because I am satisfied that when we have an address such as we have had this morning upon subjects of great importance to every Member of the Association, it affords an opportunity to Members of offering remarks and exchanging ideas on subjects we all wish to know more about. You have treated, for instance, upon sewer ventilation, the separate system, bye-laws, building societies, fees, and some other points which I did not note. I am sure that the first subject which you touched upon—that is, the ventilation of sewers—is one which is certainly not finally settled. We should find, if we were to go into it in a detailed manner, I believe, views differing from one another in our own Association, and if the subject should come up again, by some gentleman offering a paper upon it, I think we should derive benefit from inviting the medical officers to take part in it. I have given myself great attention to the subject, and if it were not that I feel that to-day is not the time to go into it, I should very much like to have discussed it. I will not, however, attempt it, because we have a subject on the agenda paper

in which I have no doubt we all take an interest. The question of the separate system which you also mentioned I believe would be an interesting one for this Association. It would be of service to many of us if we had some paper which would deal with all those towns where it has been carried out, either wholly or partially. I believe we should find that in reference to the name "separate system" there is a very considerable amount of misapprehension existing amongst us. On the Continent it was entirely misconceived; it was there understood that by it rain water was entirely excluded from the sewers proper. Now it has been stated this morning that Mr. Parry, I believe, has carried out the separate system entirely in that direction. But I should like to have heard from Mr. Parry himself whether that does not simply apply to new buildings now being erected or erected within the last few years, and not to the old buildings in the town when the first sewerage of Reading was carried out. We are all driven sometimes to adopt something partially, but if I were to speak of carrying out the separate system at Leicester, it would be quite a mistake to suppose that all rain water was being excluded from the sewers. The original sewers are found now to be much too small, so that we are obliged to lay down a separate storm-water system to take the surface water from the streets. But to carry that out in the yards would be a very serious matter, and I should like very much to hear whether anything of the kind has been adopted elsewhere. Dr. Teale's book has been mentioned, and if every Member of the Association does not know that book, he certainly ought to. The book treats the subject of sanitary mistakes so popularly, that it is not merely a book for engineers but for householders; and I know several householders who have got it and discovered all at once that they knew a great deal more about sewer gas and drains than they did before. The book has done good, and I at any rate do not think it so exaggerates the case as some people probably think. I know that I have had experience of nearly all the cases that are to be met with in it. You treated then, sir, of the bye-laws. It is an exceedingly difficult question, and when we speak of bye-laws being absolute—that is to say, not permissive—there is no doubt that we touch upon a very difficult matter indeed. I am afraid it will be next to impossible to get a set of bye-laws which will apply to all provincial towns passed into statute law. In Leicester it was attempted last year to incorporate amended bye-laws into a local Act. What was the result? When the Bill

came before Lord Redesdale, he simply struck out nearly all the good parts we wished to have in. Certificates of occupancy lead you to a difficult matter again. I can only confirm what has been said on that point. Although a provision was incorporated into our Act which enables us to prohibit the occupancy of a new house without a certificate having been obtained, I have not given one yet. I am afraid of the giving of a certificate, because I do not see how you possibly can, with the means given to local surveyors, absolutely say that any house is fit for occupancy where there are so many hidden mysteries in the matter of drainage. So long as we have not bye-laws to make them lay before us a plan and longitudinal section of every sewer and private drain with its several branches, and inspectors to see them carried out, a certificate cannot be given as to the exact sanitary condition of any house. You have treated upon building societies and may have had some unpleasant experience with societies of that kind; but I should think that differs with the locality. My friend here on my left will be able to confirm it, that at Carlisle, and I can speak as to Leicester, we do not feel so much difficulty as you describe. We find a great deal more with the builders and even architects on the Board, and it is certainly not creditable to local boards that members of their own body should place obstacles in the way of their own surveyor. They should rather support him in carrying out the bye-laws. The question of fees has been touched upon. I am very glad indeed to hear that Mr. Angell has been successful in instituting fees in West Ham, as I think a system of that kind would give us the means of thoroughly looking after many points which cannot now be done; because, if you carry out the bye-laws strictly and impartially, it is quite clear you must have a sufficient number of inspectors to see done everything that has to be covered up or that ought to be seen. It cannot be done except under such circumstances. The other matters you have touched upon are probably of equal importance to those I have noted, but time will not permit of my dealing with them now. I can only repeat that I think if the inaugural address of the President were subject to discussion, it would lead to a great deal of information being diffused amongst us, and give many Members opportunities of expressing their views upon matters of interest which they would not otherwise have, because the subjects treated of in the address are not generally dealt with at the same meeting in any of the papers. I beg to support the motion. I

think the address was an able one, and it is proved so by the number of subjects which it has led to a discussion upon.

Mr. PARRY: Reading has been referred to with reference to the separate system of drainage. On one or two previous occasions I have had to make some remarks upon it. In Reading we certainly divide the sewage from the surface water, or rather leave the surface water where it is, and take the sewage out of the old drains. We have a sewage farm, and we have land there on which we throw our sewage. In ordinary times the quantity of sewage that we should pump up to the farm is about 900,000 gallons a day; but there are wet seasons in which that quantity is sometimes doubled. The land does not want it at that time; perhaps it may want it at drier times, but not in wet seasons. That is the one great advantage of the separate system. Mr. Lobley made some remarks as to the quality of the water that is called surface water. Well, if we take all the sewage out of the surface-water drains, we think we need not care for a special standard of purity. It is called rain water; although it may get a little polluted on the surface of the roads, I think we need not take very much trouble about that. Although we have taken so much water out of the sewage for the purposes of the farm, yet in consequence of the open ventilation that we have—and which is, I believe, the best system of ventilation, opening into the streets—we use from twenty to thirty thousand gallons of water a day for flushing our sewers on the flat gradients. I have heard some surveyors in the south of England ridicule any other system of dealing with sewage except by irrigation. I am certainly not one of those who think that the time has arrived for any sanitary engineer to say that any system adopted is perfect for all neighbourhoods. There are towns in the north of England which cannot compare with towns in the south of England where plenty of land is obtainable for irrigation. Where it can be obtained, I think irrigation is the proper thing; but I cannot say that any one system will suit all towns. There have been some remarks made on the question of certifying houses on completion. We have no bye-laws yet established in Reading, but we have got the basis for bye-laws put into the Act that we obtained last year, which enables us to get a few additional points to work upon beyond what the Public Health Act gives us. One useful clause we have, and which would appear to point to there being a certificate required for houses on completion. I never wanted to drift into that at all;

I know the difficulty in which some other towns are placed. But the way I find it useful is this. It is a clause requiring a notice of the completion of a building, and that notice enables the surveyor to have seven days to inspect that house. And if in that seven days he finds that the waterworks regulations or the drainage regulations are not carried out, as well as other specialities in connection with the surveyor's department, he can give notice to the builder that it shall be unlawful for him to allow the house to be inhabited until rectified. That is helping me to carry out the waterworks and the drainage regulations. It is more useful than a certificate, as it facilitates the perfecting of the work.

Mr. JEBBAM: As to the separate system of drainage, I certainly agree with you as to the practical difficulty there is in having a separate system for every house. I quite believe in a separate system, but to have it for every house is fraught with danger. In a few years the sewage and refuse from sinks will very likely be put into the wrong drains, and we shall find all our ditches in a very polluted state in a few years. It is one of the most dangerous things to have a separate system for houses, although, as far as the roads are concerned, it is a good thing to get rid of the detritus out of your sewers. As to sewage ventilation, I have just read Sir Joseph Bazalgette's report on sewage ventilation at Brighton. If sewers are kept clean—if there is no detritus, no decomposing matter kept in your sewers, your sewers will not be foul; and I agree with what Mr. Chadwick said at the Brighton Health Congress, that it is not right you should have gases in your sewers, and it is only by decomposing matter and by having flat gradients that the gases are generated. We do not get sewage gas from live sewage, but from dead sewage. With a system of flushing our sewers and keeping them clean, with plenty of fresh air and water, our sewers will be kept right and no nuisance will arise from sewer gas.

Mr. SPENCER: I hope one remark will not be overlooked, that which tended to substantiate and improve the position of a surveyor. I do not believe among the six hundred and odd members of Parliament, that there are many philanthropists pure and simple; therefore we need not expect that any gentleman will take up our cause unless very urgently and pertinaciously solicited. I am sorry that no gentleman has proposed a resolution that the Council should take this matter up for the purpose of impressing upon the Local Government Board the desirability of introducing

into the statute law some law which shall enable the surveyors of the various districts to be dependent for their appointment not altogether on the local board, but to some extent on the central Government Board here. Of course we should immediately have screams all over the provinces as to the tendency to centralisation. But we must, as sensible men, know that centralisation to some extent is desirable. We know that the medical officer of health and sanitary inspector are admissibly allowed under the Public Health Act to have their appointments contingent on the will of the Local Government Board; but I would have the surveyor's in every case to be entirely so. I think, if that were so, a great many of the difficulties of a surveyor would be obviated. I hope that if no resolution is proposed at this meeting, that the Council will take the matter up, and will, by petitioning and other direct influence on various members of Parliament, endeavour to have it adopted. The time may come in a crisis of political questions, when even the votes of two or three hundred surveyors may be considered worth attention on the part of our worthy legislators. And therefore I think if we are only pertinacious enough, if we keep petitioning and petitioning earnestly, and never allow ourselves to take a refusal, that in time the object will be attained, even if only in twenty years. And if we attain it in that distant time, we shall have done a great deal of good. With regard to certificates, that is a difficult question; but as several gentlemen have given their personal experience, that is to say, the custom in their own district, it cannot be out of place to mention that of my own. The bye-laws there enforce that no house is to be inhabited unless a certificate has been given that the house drainage is complete to the satisfaction of the surveyor. That bye-law, I apprehend, will not be *ultra vires* because the Local Government Act—the Public Health Act—does distinctly give local bodies power to make bye-laws with regard to drainage; and I think to a great extent a bye-law of that class would meet the case. For many years I refused to give certificates, but of late years I did give, like my worthy friend, Mr. Lobley, a qualified certificate, that is to say, that the house drainage was complete—so far as I knew—to my satisfaction. And I am pleased to say that, after a time, builders began to have a wish to have that certificate. They found it valuable to them; but when there was the slightest doubt about it, I kept the matter in my own hands, and refused to give a certificate. If my own

Corporation asked me why, I simply said I was not satisfied, and there was an end of the matter.

Mr. ANGELL: May I ask, Mr. Spencer, whether you have in any case taken proceedings against builders for allowing houses to be occupied without the certificate? Supposing houses are occupied without a certificate, what is your action then?

Mr. SPENCER: I may say in answer to Mr. Angell, that at the present moment I can only distinctly recollect one case of that kind. I believe there were two or three, but I have a distinct recollection of one case in which a house was occupied where I had refused my certificate. The Corporation took the case up on my recommendation, and took proceedings, and the owner was convicted and fined by the magistrates. What would have happened if they had carried it further I am not enabled to say.

Mr. ANGELL: Mr. Spencer has obtained a conviction which would be quashed in a higher court. The Local Government Board absolutely refuse now to recognise that bye-law, and if you send up that bye-law in a new system they strike it out. There is nothing in the Act which gives you power to make such a bye-law.

Mr. LOBLEY: I have taken proceedings for houses being occupied without a certificate. Of course our bye-laws have it in, and if they had chosen to fight it, it would have been at their own risk. But I think the Public Health Act would have enabled the Corporation to show that it was not *ultra vires*. There is a section, 22 or 23, which says that no house shall be allowed to exist until the drainage is complete. The proceedings would really be taken for occupying before the certificate was given; but there would be other offences taken in the same summons, giving the reasons. So that the penalty might be said to be given, not for tenanting the house, but for not making the drains properly.

Mr. McKIE: The ventilation of sewers and drains will not be complete, in my opinion, until every yard is ventilated; if this is not done, the part unventilated will generate foul sewer air. The air as well as the sewage should be kept moving. Stagnant air as well as stagnant water will get foul. If a single yard of sewer or drain is unventilated, it is undoubtedly a great nuisance, and is one of the things that we cannot see above ground, which breeds mischief. The more I look into this subject the more frightened I am of an imperfectly ventilated or unventilated sewer or drain. The giving of certificates is a difficult matter. I found certificates given at Carlisle, and I had to give certificates.

Our bye-laws are very strict, and I get my assistants to go out and examine everything very minutely. And if, as far as they can see, everything has been carried out according to the deposited plans, then I give a certificate that there is sufficient open space to the houses; and that is my certificate.

Mr. READ: I had not the pleasure of hearing your address, but after the remarks that have been dropped by the different speakers, I should like to say a word or two about the ventilation of sewers. I have a very strong notion that in many cases the objections to the ventilation of sewers do not arise from the public sewers themselves. To take Gloucester as a case in point. In 1875 the sewerage system was extended. In doing this—for what reason I do not know—whether the estimates were cut down, or for what reason it happened—the old system of sewers was not done away with. The existing system at that time was all back drainage; the sewers were down between the backs of houses. Sewers which had been put in perhaps twenty years were nearly full of sewage; but instead of those sewers being destroyed when the new system was made in the streets, they were simply picked up in the cross streets when intersected by the new system. Those old sewers produce sewer gas which has its vent in the streets. No amount of flushing of the street sewers has any effect whatever on the back sewers, and I strongly urged upon our Corporation to spend 5000*l.* in doing away with these back sewers and connecting every house with the street. Anything we can do to the new sewers will have no effect on the old, and I believe in many cases in towns that point has been overlooked where you have bad smells through the ventilators. Perhaps not to the same extent as the case I have mentioned. With regard to certificates for new buildings, we have a set of bye-laws which were drawn up under the old Act of 1848, and under that Act there is a bye-law that a certificate is to be given after notice of completion. Well, as a matter of fact, that bye-law is a dead letter, has been for many and many a year, long before I came to Gloucester; and so it will remain until we get our new set of bye-laws, which we have lately submitted to the Local Government Board. But I think the Local Government Board are very chary of having any alterations made in their model set. They do not like them revised, and cut out several very important points we had under our old bye-laws.

Mr. SMITH: I have had something to do with experiments on the ventilation of sewers. I have had to deal with sewers of very

flat gradients, and I have found that even in cases where the tide has been over the main sewer that some complaint has been made. I have made experiments with iodine and nitrate of lead, and I have come to the conclusion after experiment that there is nothing like a continuous flow and constant flushing. Open the manhole to give as much vent as you possibly can. In Oxford the principle was adopted, and I have strictly adhered to it, almost to the letter, and I find that constant pumping, constant flushing, is really the secret of sewer ventilation.

Mr. W. H. WHITE: I should like to say one or two words. I coincide entirely with the remarks of the last speaker, and those of the one who immediately preceded him. I think nine-tenths of the smells proceed from foul old sewers and house-drains. During the last few months I have had a very large experience, which corroborates that view. But I also think, with Mr. Smith, that the only way to cure the evil—almost the only way—is by maintaining a good current in the main sewers, expelling the foul air from them as fast as it finds its way in. I am also of opinion that every house drain should be ventilated. While I am up, I should like to say a word on the question of certificates. You will not be surprised to hear that I, too, have never given a certificate, although there has been a bye-law in existence in my Board for very many years that every house shall be examined by the local surveyor, and a certificate given before it is inhabited. I have never heard of any house owner or builder being proceeded against for letting his house without obtaining the certificate, nor heard of a certificate being given by either of my predecessors. But I should like to mention a small instance which occurred lately of the danger of giving a certificate at all. It has been my custom for some few years past to insist on the drain trenches being kept open sufficiently long to enable the foreman to see that every pipe is apparently properly laid and jointed. He fills up a form with which he is supplied, stating the day and hour at which this was done. In fact, it forms a kind of certificate from the drain foreman. A small property changed hands recently, and the seller gave this so-called certificate to the purchaser. The drain was found to be stopped up very shortly afterwards. The purchaser came to my office and, as has been said by a previous speaker, he flaunted this certificate, and loudly stated that he meant to sue me or the Board in a court of law for the damage he had sustained and the loss he had been put to. I found that after this drain had been laid and examined,

an additional length had been laid of which I knew nothing, and it was there that the stoppage occurred. But this case serves to illustrate the danger of giving certificates unless there is a proper staff to secure rigid supervision. I presume that the individual alluded to took legal opinion as to the possibility of proceeding against me, and that luckily for me the opinion was adverse to his claim, as he certainly took no further steps in the matter.

Mr. TILL: You, gentlemen, have all heard the proposition, in which I must say I most cordially agree, and which I understand to be that the best thanks of this meeting be tendered to the President for his Inaugural Address.

Carried unanimously.

The PRESIDENT: Mr. Till and Gentlemen, I thank you for the cordial reception you have given to my address. The subjects touched upon are equally important and interesting to us all, and the greatest difficulty one has to contend with, is to treat them so as to open up a fair field for discussion, and at the same time to bring them within ordinary limits. Several matters have been touched upon in the discussion to which you will hardly expect me to reply, at the same time I am glad that the ordinary rule having reference to the President's Inaugural Address has been, in my case, departed from, the more so as these Annual Meetings are more representative than our District Meetings can possibly be. The papers and the medical opinions to which I have referred will be found in the *Lancet* of May and June. One paper is exceedingly valuable although we cannot agree entirely with the views expressed, nor do we think that they will commend themselves absolutely to the mind of any really practical sanitary engineer. The book referred to is 'Dangers to Health,' by J. Pridgen Teale, M.A., Surgeon to the General Infirmary in Leeds, it is exceedingly interesting, and although there may be nothing very new to the sanitarian, I look upon it as a valuable addition to our sanitary literature.



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ANNUAL MEETING IN LONDON,

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PRIVATE STREETS AND THE 152ND SECTION OF THE PUBLIC HEALTH ACT 1875.

By H. O. SMITH, ENGINEER TO THE COMMISSIONERS, CHISWICK,
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The chief object of this short paper is to elicit discussion on the subject of taking over private streets as highways repairable by the inhabitants at large, in consequence of the decision of the Right Honourable the Master of the Rolls in *The Attorney General (at relation of Local Board of West Ham) v. Bidder and others*. This case arose out of the following circumstances. The West Ham Local Board, being the Urban Sanitary Authority for their district, gave the owners of a private street within their district, named Lili-put Road, notice to sewer, level, pave, metal, flag, channel, and make good the same, and to provide it with proper means of lighting. As the notice was not complied with in the prescribed time, the Board executed the works in the usual manner and according to the plans previously prepared by them, but in doing so did not flag or pave it, as these works were not considered necessary. When the work was completed the Board caused a notice in the terms of the statute and under the 152nd section of the Public Health Act 1875, to be posted in the street, setting forth that it had been "sewered, levelled, paved, flagged, metalled, channelled, and made good, and provided with proper means of lighting" to their satisfaction, and giving notice that it would be taken over as a highway repairable by the inhabitants at large, unless the usual and necessary notices of objection were duly made. The owners made an objection, which was not considered correct in form by the Board, and the street therefore became, in the opinion of the authority, a highway repairable by them. The owners had fixed a fence across the

street, their reason for doing so being that a route to the Albert Docks would be opened *via* Liliput Road, which would diminish their income from the tolls they received from vehicles going to the docks by the old route. The proceedings in question were taken at the instance of the Board to have the fence removed.

In giving judgment his Lordship laid down the law as to the meaning and intent of the 150th and 152nd sections. As it is of primary importance, the following extracts are here given from it. After giving it as his opinion that the 150th section and the 152nd section were not correlative, he proceeded: "The object of the 150th section is this: it entitles the urban authority to require the owners of a private road to do such of the works specified in the section as are necessary for the protection of the public. . . . They may require the owners to do one or all of several works, and then they may call upon the owners to pay for the works done. That is a large power to place in the hands of an urban authority, and they are not to exercise it except so far as it may be necessary. Supposing that there is a small lane which has very little traffic and has a hard metalled road, and the authority consequently do not see any necessity for its being paved, as it does very well without, but the lane requires to be lighted for the protection of the public at night; in such a case the sanitary authority may, under the section, require the lane to be provided with the means of lighting, and may call upon the owners of the houses to pay for it. Supposing the lane is lighted, and the authority do not want it to be paved, but consider that there should be a sewer, they may require a sewer to be made, having reference to the gradients of the district and the sanitary arrangements of the inhabitants of the adjoining houses, and the owners of the houses must pay for the work. . . . Now, when we come to the 152nd section, it is a section of a totally different character. It is in substance this: that in certain cases, if the owners of the soil in the road do not object, the authority may take to the road, and turn that which was a private road into a highway repairable by the inhabitants at large; subject to this, they must not do so until the road is properly formed. . . . The Legislature said this: 'When a great many things have been done, and not till then, you may dedicate for the use of the public. When any street within any urban district, not being a highway repairable by the inhabitants at large, has been sewered, levelled, paved, flagged, metalled, channelled, and made good, and provided

with proper means of lighting to the satisfaction of the urban authority, such authority may give notice of dedication.' But all those things are to be done. I am told I am not to read the section literally. I cannot read it in any other way." He proceeded to say that if the local authority was to be the judge of what constituted the proper making up of a street, "the Legislature would have said, 'when any street is made to the satisfaction' of the authority. But it is not so. The Legislature has pointed out what must be done 'to their satisfaction.' The present case, therefore, in my opinion, is not within the 152nd section, because all that which is required to be done has not been done."

This is, without doubt, sound law; but it is, nevertheless, a little startling when the practice of urban authorities under the section is remembered. It has hitherto, for want of a decision like this, been considered, that when a private street has been made up to the satisfaction of the urban authority, it could be taken over by them. A literal compliance with the terms of the section has not been regarded as a condition precedent to such a step, for many reasons. It has not appeared to be a reasonable use of the "large powers" to compel the owners of a private street to pave the carriageway and flag the footways, when it joins one of the public roads that has its carriageway metalled and its footways tar-paved. Then, further, what authority would think of asking for a literal compliance with a section that allows them to take over a private street that is not kerbed, and yet insists that it is to be "paved, flagged, *and* metalled"? If it is to be literally construed, it appears to be a good-natured attempt on the part of the Legislature to teach surveyors how to make up roads. If it is assumed that flagging refers to the footpath, it follows that the carriageway has to be metalled and paved. It is a matter for regret that the Legislature did not complete its lesson by stating whether the metalling was to be on the paving, or the paving on the metalling.

Leaving the interesting question of the position of those urban authorities who have declared private streets highways repairable by the inhabitants at large, which were not sewered, levelled, paved, flagged, metalled, channelled, and made good, and who have in good faith repaired these streets, for our friends the legal advisers to determine, let us look at the specification prepared by the Legislature, and endeavour to see how far it can be complied with. There is no difficulty in taking action under the 150th

section, if the street has not to be taken over under the 152nd section. But the practice of most local authorities is to take over the streets where they have used their powers under the 150th section, and it is unquestionably a just practice. It appears unreasonable to compel the owners to make up a private street in an expensive manner, and to the satisfaction of the authority, and to pay their shares of the general rates; and yet to ask them to repair and maintain the street at their own expense, and especially so when the only thing in the way of its being declared a highway repairable by the inhabitants at large is a section with which it is an absurdity to comply. There can be no doubt whatever that surveyors will be called upon to prepare plans under the former section, so that when they are complied with the street may be taken over by the authority. The first requirement, then, is "sewered." By the interpretation clause, the word "sewer" is defined to include sewers and *drains of every description*, except private drains and drains vested in or under the control of any authority having the management of roads, and not being a local authority under the Act. This is wide enough to include surface-water drains and their appurtenances, whether the same be connected to the sewer, or whether they be on the separate system. The next word is "levelled," about which there can be little doubt. Then follows "paved." When applied to carriageways it may include granite or other stone pitching, and wood pavement. Can asphaltic paving be considered within its limits? When applied to footways it may include York or other stone paving, and brick paving. Do Victoria stone, cement paving, tar paving, and the many kinds of asphaltes, come under its strict interpretation? Then it has to be "flagged." This surely applies to footways only, and must mean flagging with large flat stones. It has also to be "metalled." In London and district the word "metalling" is reserved to describe the roads made with broken granite, but in the provinces it includes all kinds of macadamised roads. Which is the "literal" interpretation? Is a carriageway made of flints or gravel "metalled" within the meaning of the section? Does "hard core," consisting of the sifted hardware from the dust-heaps come under it? Next comes "channelled," which admits of no difficulty as to its meaning. Then follows the indefinite requirement "made good." Can this be literally interpreted so as to include kerbing, which seems to have been carefully omitted?

As a literal compliance with the section by "paving, flagging, and

metalling" a street is out of the question, what is to be done with these private streets? Are they to remain muddy, undrained, and disgraceful to the district, as they leave the hands of builders? It is easily seen that when a street has been made up by the authority, the houses that were before unoccupied become tenanted on its improvement; but now, has this to cease because it is ridiculous to comply literally with the section?

In the parish of which the author has charge, notices have been served upon the owners of twenty-five private streets under the 150th section, with the unwritten understanding that they will be declared highways repairable by the inhabitants at large when they are completed according to the plans and sections which have been prepared. The specification is substantially as follows: the footways are to have a foundation of gravel and 3 inches of *tar paving*, the kerb is to be 12-inch by 8-inch flat Aberdeen or Guernsey granite, the carriageway is to have a foundation of hard core where necessary and 6 inches of Kent pit flints as the *metalling*, and the channeling is to be made with *one* row of granite pitchers 7 inches deep and 5 inches wide. The surface-water drains are to be on the separate system, and the sewers of the usual character. When they are completed to the satisfaction of the Board they will be fit to be taken over as highways repairable by the inhabitants at large, although they may not be "*flagged, paved, and metalled*," in the terms of the Act.

DISCUSSION.

MR. LOBLEY: Perhaps it will be no harm to confess at once that the position I wish to take is one rather defending the judgment in this particular case; but I wish it particularly to be understood that I do not defend all the side issues that are raised thereby. I simply wish to defend the judgment as it stands on its broad merits, as connected with the West Ham case. It must be understood—perhaps Mr. Angell will correct me, as I am speaking off the book—that in this particular instance no objection was taken in West Ham to the wording of the 150th section. The objection is raised on the 152nd section, in which the Local Authority took over a street, believing that they had power to do so. No objection was raised to any portion of the works carried out, or ordered to be carried out, by the Local Authority. The only objection was

whether they should take it over and declare it to be repairable by the inhabitants at large. And I believe the footways were only gravelled; I presume it was kerbed and channelled, and that the roadway was metalled in the ordinary acceptation of the term—broken stone, not round pebbles. Well, it seems to have been thought—I believe it has been expressed by Mr. Angell—and it is now suggested, I think, by Mr. Smith, that this is a new departure, that there is a change here in the reading of the law from what has been customary. Well, I can only speak for myself; I have had a great deal of experience in this particular work. It carries out my practice, which has been my practice, both in Hanley for the last eleven years, and in Liverpool where I carried it out for ten years previously. It was ruled there exactly the same as now by this judgment, and so for twenty-two years my practice has been to carry it out exactly in accordance with this judgment. I referred to the side issues. They are matters of detail. They do certainly affect the judgment in a certain sense. We all know that an arbitrator may give his judgment, but is unwise to give reasons; but I suppose judges are above arbitrators, and he proceeded to give reasons, and perhaps I may find some fault with the reasons that I don't find with the judgment. The practice in Liverpool has been that no street can be taken over until kerbed, channelled, flagged, and paved.

Mr. ANGELL: Are you speaking of a local Act at Liverpool, or the Public Health Act? If they have a private Act, it gives them different powers.

Mr. LOBLEY: Yes, they have; but the powers are similar under the Public Health Act. As Mr. Angell has said, Liverpool ought not to be mentioned, because they probably work under a private Act—it is so; they do work under a private Act. But Hanley does not. I will take Hanley, therefore. I found the specification in force eleven years ago and have simply carried it out. I have always advised the Council—probably I may have been biassed by my previous practice under the Liverpool Act—I take the Public Health Act and its predecessors, the Local Government Act and the previous Public Health Act, as they stand, and I have always advised the Local Authority that they have full power to require what work they deem necessary to a street under the 150th section, but have not power to declare the street a public highway until all these matters are attended to. When we come to the difficulties with regard to the different terms, then I admit that there is very

considerable difficulty in the case. Now, for instance, we require our footpaths to be paved with blue bricks; we don't require them to be flagged. Clearly the word flagging is not required, and there I must agree with Mr. Smith that there is a difficulty. But it must be understood that this case did not arise in West Ham, that the footpaths were only gravelled there, that there was no substantial permanent paving such as that laid down in their principal leading streets. My position is this, however wrong the details of the judgment may be, the ultimate idea, if I may so call it, is that each particular part of a street should be completed in its permanent position, equal to the best streets of the same district. As we do not require flagging in our streets, therefore brick paving is the substitute for flagging. I maintain that no local authority has any power whatever to be satisfied with anything less than that, but would have power, if they chose, to require flagging or any other permanent substitute for flagging. You will at once see that I admit the difficulty here. Kerbing is left out of the section. That is a difficulty certainly. Kerbing ought to be put in; and the word channelling may mean paving with channel stones. Now, with regard to the metalling. Clearly if you pave the middle of the street, or require the owners to pave the middle of the street, you cannot require them to metal it as well. And therefore, to my mind, whatever the local authority require to be done to the carriageway, whether it is metalling or paving, they should be interchangeable terms. There is one clause in the paper—"It has hitherto, for want of a decision like this, been considered that when a private street has been made up to the satisfaction of the urban authority, it could be taken over by them." That has not been considered the case in my district at all. At Hanley or other towns adjacent in the North Staffordshire district none of the authorities have considered that they have the power to adopt a street simply on their own mere declaration of satisfaction. I believe that the clause is distinctly worded, and the law is intended to be laid down to prevent town councils from taking over streets not thoroughly and properly made up in every respect as they ought to be. But I do not think it was ever intended that the word flagging should be really flagging, and not apply to any other system of permanently making a footway; or that the word metalling, again, means that you must metal the streets and not pave. Clearly of the three words, paving, metalling, and flagging, you can only have two of them, unless you divide the

carriageway or the footpath into two portions. You must have only two of these. You must either pave or flag the footpath, and either pave or metal the carriageway. You cannot do both, and therefore I would confine my remarks to defending the judgment in its ultimate results, viz. that the local authority has no right to adopt a street until all parts are fully completed. And therefore, taking the case alongside the judgment, I certainly think the West Ham Local Authority had no right whatever to declare that road a public road when the footpaths were merely gravelled. There is a peculiarity about the means of lighting which is certainly a difficulty, and I think it ought to be remedied by an alteration of the law. I know in Liverpool they never think of requiring owners to provide the lighting of streets; they light them under their private Act. But in Hanley we light the whole district by virtue of the law which enables us to light the district as a district, and I have not heard that any case in the higher courts of law has ever been settled denying the right of any authority to erect a lamp post in any private street. As to those portions of the paper which show the necessity of dealing with these streets, I do not think the judgment affects that. It leaves the authority with full power to require the sewers to be made in a proper manner, and each part of the street to be made in a proper manner. For instance, the question, "Are they to remain muddy, undrained, and disgraceful to the district, as they leave the hands of builders?" I do not think that question is raised at all by the judgment. No one ever said they should be left in a muddy, disgraceful state. On the contrary, no bar is placed on the action of the local authority to serve notices under the 150th section; it is only to dedicating the street. I do not know how many Members of this Association have been conversant with a Bill before the House of Commons; I am afraid there is very little hope of its passing. It is a Bill to amend this particular section, and it improves the law in this respect in a very great measure, and I only hope it will be brought forward again next session and become law, subject, of course, to some slight alterations in detail. But, in short, it enables a local authority to do the flagging, or the sewerage, or the metalling, or the paving, and adopt—that is to say, take over—just that part which they have done, without relieving them of the power to require the rest to be done whenever necessary. It would therefore be in the power of a local authority, if they thought a street had not sufficient buildings on, to require a street to be sewered and metalled, and leave the

footpaths to some years later to be dealt with then. I think this improvement in the law would be a very great advantage.

Mr. ANGELL: Mr. President, as this now somewhat celebrated decision of the Master of the Rolls arose out of a case of mine in West Ham, I may perhaps be expected to make a few observations upon it. In some way or another, West Ham is always coming to the front. I remember some sixteen years ago when West Ham applied for its first private Act—there have been several since—Lord Redesdale said, “Where is West Ham?” Before him, the other day, upon the Building Act, I said in answer to some of his observations, “They are building some 3500 houses a year in West Ham.” “Hum,” said Lord Redesdale, “it’ll be bigger than London soon.” This particular case, which has affected the interpretation of the law throughout the country, arose entirely out of a side issue—nothing whatever to do really with the making up of the road. In 1875 the London and St. Katharine Dock Company got powers to construct a new dock—a very fine dock, the Royal Albert Dock—and West Ham, in order to secure the communications of the district, got a clause inserted into the Dock Act for the construction and maintenance of a public road through the docks, so that the district should not be severed. That new road when completed, happened to abut on a short, a very short length of road, the property of Messrs. Bidder. The Victoria Docks were originally constructed by Peto, Brassey, Betts, and people with whom Bidders were connected, and they made roads which have never been dedicated. When the new road was constructed, Bidders saw they were masters of the situation if they closed their short piece of road. Houses were built on one side of this short piece of road, and a railway on the other. Great complaints came to the Board of its condition. We served notice on the owners on either side. It came very hard on the Great Eastern Railway, who paid the whole of one side, and the owners on the other side paid the other half. But Bidders, in granting the building leases, or whatever they had granted, had retained to themselves the freehold of the road. We served notice on the owners, and, as you know, we have a private Act by which we can recover the money first. We recovered the money and made up this piece of road according to our usual practice. Having got the money, and made up the road, we put a notice up at either end, stating it would be dedicated. The month passed, and of course the Board and everyone supposed it was dedicated. No sooner had the fact got about

that it was dedicated, than Bidder put a toll bar at either end, so as to catch all the traffic going to the docks. I was instructed to remove that bar, and I did, whereupon Bidder commenced an action against us for trespass, and they put up the bar again. Well, of course it was not worth while continually pulling down bars. We commenced an action against Bidder to restrain him from obstructing the road. Our action was tried first, and out of that came the decision of the Master of the Rolls. Therefore, you see it is entirely a side issue, but it has governed the interpretation of the 152nd section for the whole of the country. Mr. Smith has already given you the substance of it in his paper. The whole point turns upon this. In the 150th section the word is "or"—if a street is not sewered, levelled, &c., *or* is not lighted to the satisfaction—you may then serve a notice requiring them to do this, that, or the other. But when you come to the 152nd section the word "and" applies. I must say that I, if one may be so presumptuous as to say so, perfectly approve and agree with the judgment of the Master of the Rolls. One never saw it in that light before, but it means that *all* these things, if you dedicate, must be done to the satisfaction of the board, and you cannot dedicate till every one of these things have been done to the satisfaction of the board. It is not satisfaction, as the Master of the Rolls said, if it is not done at all. And one remark was made by the Master of the Rolls worthy of observation. Mr. Justice Chitty, our counsel, said, "The local board are placed there as the guardians of the purse of the local district, and they may dispense with the doing of these things."

"*The Master of the Rolls*: They cannot dispense with anything. The Act of Parliament never entrusted a local board with power to throw the expense of making streets on the public. Otherwise the friends of the landowner would get a majority on the local board and vote away the public money to make streets."

So I suppose the Master of the Rolls has lived in some district where he found some irregularity going on; at all events, he seemed very much impressed against local boards. I quite agree that this is the correct interpretation of the Act, but I think that there ought to be more elasticity in the section. In the 149th section of the Public Health Act you will notice, with regard to public streets and highways which are within the authority of the board, "The urban authority shall from time to time cause all such streets to be levelled, paved, metalled, flagged, altered, and repaired, as

occasion may require," &c. You see there is plenty of discretion, but in the case of dedication of new roads all roads must be stereotyped throughout the country. They are all to be made in one particular way. There is no discretion at all, as Mr. Lobley has suggested, about using bricks or tar paving. Wood paving is not a compliance with the Act; asphalt is not; tar paving is inadmissible; the tiles and bricks referred to by Mr. Lobley are not within the Act. There is no discretion left on any point, as will appear from the Report.

"*Mr. Chitty*: It could not be an objection to your dedication if, instead of being metalled in that way, the road was paved with wood.

"*The Master of the Rolls*: But it would. It is not within the Act. If a builder chooses to make wooden pavements, it would not be within the Act.

"*Mr. Chitty*: That would be a very strict construction of the Act.

"*The Master of the Rolls*: Not strict at all; it is the construction. The Act of Parliament says you shall not throw the expense of repair on the public unless the road is in a certain state.

"*Mr. Chitty*: 'Paved, flagged, metalled, and channelled.' These words override each other; it cannot be required that each of these things shall be done.

"*The Master of the Rolls*: Yes it is.

"*Mr. Chitty*: If it is paved with wood that would be a good pavement.

"*The Master of the Rolls*: It would not.

"*Mr. Chitty*: I submit to your lordship that it would.

"*The Master of the Rolls*: You see it is *and*; all these things must be done.

"*Mr. Chitty*: To my satisfaction; it leaves me with a discretion as to the nature of the works.

"*The Master of the Rolls*: No; it does not."

So that you see now we are very circumscribed. You must simply do the particular things in the 152nd section. There is no doubt the words do overlap. By the way, this case went before Baron Pollock, and he confirmed the ruling of the Master of the Rolls; and to show how little technical knowledge they have, I had very hard work in conveying to Baron Pollock what "metalling" means. He lives somewhere in the chalk country, and he got into his head that those nodules of flint you put on the road were

"metalling," and that gravel is not "metalling." I certainly think there should be an amendment. I may say further that this ruling having been confirmed by Baron Pollock, we went to the Local Government Board, calling their attention to the judgment; and they wrote back to us that they thought they must certainly assent to the judgment given, but would consider the question whether there should be any alteration in the matter, and you know what "consideration" by the Local Government Board means. My own opinion is that there should be considerable amendment in the word "flagging." In some parts of the country blue bricks are very suitable; in some tar paving is sufficient without flagging. It is a question whether patent stones would come within the description of flagging. It has already been pointed out that there is not one word about kerbing. They have been very precise in using certain terms, but have entirely omitted the word kerbing. The Master of the Rolls thought kerbing was a part of flagging. The result of this decision is that there is scarcely a road in the country which is dedicated; and if anyone chooses to amuse himself with surcharging the boards for the repair of those roads, it would afford plenty of occupation. With regard to lighting, I think the requirement of lighting is a most unreasonable one. It is an impossible requirement. How is it to be carried out? Private people cannot compel the gas people to put down mains and posts; and who is to pay the gas company? What security have the gas company to be paid for the gas supplied to the roads? I look upon gas lighting as a moral necessity for the district quite apart from the repair of the roads. It has been the practice in West Ham that wherever a road requires to be lighted, as a matter of public necessity it is lighted. I certainly know no instance, under the 1875 Act, of a road being lighted by private people. Of course there are difficulties. The Act is very precise about the scale of sections and matters which might very well be left to the discretion of surveyors; but when it comes to the real questions, it is silent—or worse than silent; it creates difficulties. There has been some correspondence about how we may evade this decision, and the Highways Act, 5 and 6 William IV., has been quoted as a way by which we may evade the decision. I see some gentlemen here who, I think, come from the district in which it is proposed to adopt this evasion. Under the 23rd section of the Highways Act the process was this: if you wanted a road dedicated you were to give three calendar months' notice to the surveyor of the parish of your intention, and

if the road is properly made up then two justices come down and view. It must be to their satisfaction and the satisfaction of the surveyor. Then you must go to the quarter sessions. After that, the road must be kept in repair for twelve calendar months, and the justices go down again—that is, fifteen months at least after the original application—and view the road. Then the road may become a public road. In the meantime, an inquiry must be held before the vestry, whether it is a road of sufficient utility to be adopted. And I must say it is utterly unworthy of a local board constituted under the Public Health Act, to try to get behind an Act of Parliament and dodge a legal decision. It is a process which I should never willingly assist in, and shall advise my Board not to pay any regard to. There are other questions beyond this decision, I think the Act is very defective indeed on the method of apportionments. It is based on frontage. That I think is utterly unfair. Other parochial charges are based upon rateable value and not upon your “frontage.” By referring to the diagram each of the houses *a, b, c, d*, has to pay on 20 feet frontage. Take one, *b*, which is a storey higher than the others, and has part of its neighbour’s garden, and rated 10% higher than the others, say 30%, the others being rated at 20%, and yet by “frontage” it pays the same as the adjoining houses of less value. The unfortunate owner of *e* has also a 20% house, but having 60 feet abutting on the street A, and 20 feet abutting on street B, he has upon the same rental and rateable value as the others to pay upon 80 feet of so-called frontage, or three times more than his neighbour *d*. I say this is manifestly unfair. The terms of the Act are very doubtful. The 150th section requires notices to be served on the owners “fronting, adjoining, or abutting,” but the apportionments are to be made upon “frontage.” What is frontage? The owner of the field D makes a road at the back of the houses *a, b, c, d*, &c. The local authority serves notices on the “abutting” owners to make up the road; having previously paid for road A on which they front, they now have also to pay for road C on which they back but do not require. If *a, b*, &c., is “frontage” on street A, it must be *backage* on street C, and *e* must be *sidage* in street A; I have had such cases, and very hard cases they were to the owners. Again, suppose *k* to be an ancient footpath, who is the adjoining owner—the local authority or *l*? Can you call on *l* to make up the road? The President shakes his head, but the

local authority is not the owner of the soil, the public have only a right of way. Or again, take the intersections K, K—upon what do they abut, or front? Simply upon points, which have neither “length, breadth, nor thickness.” Sewers also intersect at these points, with a costly manhole, but there is no provision in the Act for the incidence of these expenses; on whom are they to be charged? The general practice is to distribute the expenses of this “No man’s land” over the whole of the adjoining streets, but I very much doubt whether it could be defended. With regard to the separate system of drainage referred to by Mr. Smith, the idea of a separate system was not conceived at the time of the framing of the clause, I very much doubt whether you can call upon the owners to lay a separate system of drainage. I think there should be power in the Act to make the original owners of the estate responsible for the requirements of the Act. A person lays out an estate, builds houses, and leaves the poor unfortunate purchasers, who did not know the law, with these charges. In banks and stock-jobbing companies you cannot clear out so easily; your responsibility attaches for some years. I think that principle should be extended to those who lay out estates originally. The Bill brought into Parliament this session by the Municipal Association has been referred to. It has, to my mind, some very good points, and I think some very difficult ones. I think it will make the process of the surveyor’s work very much more difficult. For instance, when you have served these notices, there are all these points to be allowed to the owners. He may object on any of the following grounds:—(1) That the alleged street or part of a street does not form part of a street within the meaning of the Act; (2) that the street or part of it is wholly or partly repairable by the inhabitants at large; (3) that there is some material informality or error; (4) that the proposed works are unnecessary or unreasonable or that the cost is excessive; (5) that any premises ought to be excluded or inserted; (6) that the apportionment is incorrect upon some matter of fact. You see there are a great number of suggestions actually proposed to be put in the Bill to set people’s intelligence at work to see how they can get outside your notice. I think there are quite enough difficulties at present without these being formulated in an Act of Parliament. The Bill is too long for me to occupy your time with; but it appears to meet those matters raised in Mr. Smith’s paper. The word “macadamised” is used in addition to the word “metalled”; the word “or” is used instead of

"and," giving Boards discretion; and the 14th section provides this:—"Whenever any street not repairable by the inhabitants at large, or the carriageway or footways only or any portion thereof respectively, has been sewered, formed, paved or otherwise completed by the sanitary authority under this Act, they shall by notice to be fixed up in such manner as the principal Act in such cases directs, declare the whole or part of such street, as the case may be, a highway repairable by the inhabitants at large, and thereupon the whole or the part of the street defined in such notice, whether the same be the carriageway or footway, shall, notwithstanding anything to the contrary contained in the principal Act as to declaring private streets highways, become a highway repairable by the inhabitants at large." That would get over the difficulty; if the required things are done to the satisfaction of the board, you can adopt it. The Act also takes it out of the power of private parties to do the work themselves. You are to make your plans and apportionments, and when everything is settled, the board proceeds to make up the street. Having made up the street it is dedicated.

The PRESIDENT: Get the money first.

Mr. ANGELL: No; you cannot get the money first. That is the West Ham clause. We had really no money to lay out for such purposes. We might lay out 30,000*l.* or 40,000*l.*, and wait for it. Where is the money to come from? You would have to take it out of the rates or a loan. West Ham has power to obtain the money first. Of course there is a great deal of grumbling about it; but since that we have not lost a farthing.

Mr. LOBLEY: As Mr. Angell has alluded to the apportionments, I may perhaps be allowed to answer in two or three words. As Mr. Angell has asked for information as to the practice in certain cases, it cannot be taking up the time unnecessarily if I just suggest one or two points. The intersections alluded to, and shown on that plan, opposite the end of streets, has been a difficulty no doubt to every person present in this room. I will merely say that in Liverpool—I have not been able to find it in the private Act, but I merely cite it as an instance of how they get over the difficulty—those portions enclosed in dotted lines are charged to the local rates, and that practice seems to me to get over that difficulty. With regard to other difficulties—to what we may call "side frontages," it must be evident to any one who has been sending out large bills on a small house, that this matter

ought to be amended. But there are very great difficulties in the matter. For instance, that piece of ground—if it is a piece of new ground, who can tell where the houses will front? But all these difficulties seem to be met by this Amendment Bill; certainly it requires some amended Act before they can be surmounted. It enables an apportionment to be altered according as the local authority may see fit, and these questions have to be settled after certain notices have been served on the owners. It no doubt causes detail, but it makes the work very much safer, and it leaves a certain power of equity to the apportionment, and it enables that very case of “backage” to be excluded from the apportionment. And it meets the case of intersections. It enables these parts to be charged on the rates, because the Act contains a clause enabling the local authority to contribute as they see fit. The only difficulty is, it does increase the work of the surveyor. These apportionments have to be estimated first, and have to be appealed against, and established, before the work is done.

Mr. WHITE: Mr. Angell has referred in his speech to these works being done out of the rates. Does he mean that a special rate is levied?

Mr. ANGELL: In West Ham we obtain the money first.

The PRESIDENT: It is not a difficulty with you.

Mr. ANGELL: It is a difficulty in the country if you do all these works out of your own resources; but in West Ham we get the money first. Some years ago we obtained those powers.

Mr. WHITE: In my own district, with regard to those pieces at the intersection of the roads—I dare say we have acted illegally—but the cost is all charged on the owners. The cost of the whole work has been lumped together and apportioned upon the owners. I think that is the general practice, however illegal it may be.

Mr. ESCOTT: We have a very important paper of Mr. Smith's to discuss, and also, I think I may say as important, the question of apportionments. I am sure on the question of apportionments we should all like to have a say in it, and it has been a very interesting account that Mr. Angell has laid before us. But I should like also to say a few words about the paper. If we are to discuss both subjects, I think we shall be here till midnight. In reading Mr. Smith's paper it struck me that there must be a side issue in the case, and I cannot see that the judgment can at all affect the carrying out of the 152nd section. At first, when I read the judgment, I thought the whole thing must be revised—that there

would be some difficulty. But now when I see that there were what I may almost term "vested interests" in this trial, I am not at all surprised at the decision which was given. I think it was a very hard case where any individual had property or an interest in receiving tolls over a road to the Albert Docks, that the local board or corporation should use any powers that they might possess in order to deprive them of their tolls.

Mr. ANGELL: No toll was thought of before we had dedicated that road.

Mr. ESCOTT: I will leave myself in the hands of the Chairman.

The PRESIDENT: This is an explanation which I think Mr. Angell should give.

Mr. ANGELL: I should not have risen but that Mr. Escott was referring to an expression of mine which he entirely misunderstood. Tolls were put upon this road after the dedication, where there never had been a toll before. Mr. Bidder found the road was well made up at other parties' expense and put the toll on it. It was an after-idea, altogether.

The PRESIDENT: I think it would be better to confine the discussion to the paper. If we go into the question of apportionments it will occupy us a long time. Supposing we drop the apportionments altogether, and if we have a quarter of an hour to spare, perhaps we may take it up again.

Mr. ESCOTT: I read "The tolls they received from vehicles going to the docks by the old route." If they received tolls, I say it was not fair for any corporation or local board to use their authority to open another road over their land and declare it public. You might just as well take a road that is a great improvement, as I dare say it is done sometimes, and declare it public without paying the owners any portion of the works. That is done. I have known cases where the works have been carried out to the satisfaction of the local authority, and it has been found that that road would become a public improvement. Now the owners of adjoining property will not allow the authority to declare it public without having some consideration. And it is only fair that in this case, where they would have been deprived of their rights, they should demand payment. Therefore, I do not think we have anything to fear from this decision. The only thing that has ever given any trouble in my experience is the lighting, and I do think it is exceedingly unfair to charge private people with the lighting of the streets. As to the amendments now before the House, I do

not like them. They throw great responsibility on the surveyor, and I think nothing could be more clearly set forth than what we have now.

Mr. BOULNOIS : I should like to say a few words on this paper. Is it necessary for a private street to make a sewer large enough to drain other districts? That is a point that rises, and if other Members have anything to say on the subject, it is a point which I should like discussed. I should like to ask Mr. Angell how they manage about getting their money first. We all know that estimates are rather stretchable. If there is a balance, is that balance returned, or does it go into the pockets of the ratepayers? I do not know whether Mr. Angell will wait; perhaps he will answer it at once.

Mr. ANGELL : We make the apportionments as suggested in this new Bill upon what we believe the works will cost, and we proceed to recover it before the magistrate. If we have made it too little, we summon them again for the balance. If we have too much, we return it rateably, if it is worth returning. Sometimes this kind of thing occurs, that you will have to return only a few pence per foot. In this case it is too much trouble to return it.

The PRESIDENT : It goes into petty cash.

Mr. ANGELL : But whenever there is a substantial amount to return, we return it.

Mr. BOULNOIS : Then as to the notices. After serving the notices, it would be quite possible for each individual to do the work himself. There is nothing in the Act to prevent each man trying opposite his own doorway to do the work himself. Then with regard to levelling the street—does that mean longitudinal level, or cross section? Is it possible to lower the level of a street to meet other streets made? I believe it has been decided that that cannot be done, and it makes the Act inoperative. In Exeter, the city I represent—it is generally in suburban roads, and there we never think of paving and flagging the footpaths—we have gravel footpaths and ordinary macadamised roads. In Exeter we have had no difficulty in recovering the money—thanks to the gullibility of the public and their not knowing. There is no doubt if they chose to do so they could repudiate.

Mr. LEMON : I am afraid I cannot agree with Mr. Escott about this decision. I am afraid it stops all future action. That is clearly the opinion of the Local Government Board, because they are already promoting a Bill to remedy what I consider a defect

in the Act. I quite agree with Mr. Lobley that the 152nd section, as defined by the Master of the Rolls, is as clear as possible. It clearly says that the owners must do all the things mentioned in the section before the authority takes over the road. I know from my own experience that that is not the working of the Act; still, nevertheless, it is the strict legal meaning of it; and now we have a decision upon such high authority as the Master of the Rolls, one of the best men you could possibly go before—when you have a decision like that, subsequently confirmed on appeal, I don't see how any local authority is going to dedicate a road to the public unless all the requirements of that section are complied with. I think it renders the local authority absolutely powerless. Unless this section is remedied, as it is proposed to do by the Bill to which Mr. Angell has referred, nothing whatever can be done as to dedicating roads. I should like to say a word on the apportionments, but I am afraid I must not trespass on that.

Mr. EAYRS: The decision is certainly a very extraordinary one to many Members of the Association. I quite agree with Mr. Lemon that it will tend to stop a great deal of good work throughout the country. Take my own case. We commence with the word "sewer." In a great many of our public streets we have no sewers at all. If we are going to put a sewer down a private street, where is it to run to? The next question is about paving. Nearly all my roads are macadamised roads, and we should not think of calling upon owners of property to pave roads where we have no paved roads to connect with; and especially in suburban localities, where you have villas, it would be a great shame to compel them to bear the noise of granite paving. We hardly ever pave in the neighbourhood of Birmingham; a great many public roads are not paved, even with bricks; and to compel owners of short streets—private streets—to flag them with flagging, or lay down blue bricks—which, of course, are not in accordance with the Act—that would not be insisted upon. I may say we are placed in a very awkward position by some streets already made. We have now a couple of thousand pounds spent in making up private roads, and we cannot recover the money because we cannot dedicate; we cannot apportion the cost for recovering the expenses.

Mr. GAMBLE: There is a large power placed in the hands of urban authorities, which they are not to exercise unless necessary. As to providing the means of lighting, we took an opinion upon that point, and were advised that the clause only required the

carrying out of structural work and that owners need not light the street. In this case they provided the means of lighting, but within a month all were taken down again; they never lighted. Another point is, you must obtain your money within six months of the work having been completed. Mr. Angell mentioned that the Highway Act was a kind of back door to get over some of the difficulty, but I question whether that would apply to towns having a separate court of quarter sessions, but only to rural districts?

Mr. ANGELL: To the whole country.

Mr. GAMBLE: With regard to the landowners' responsibilities as to the roads, &c., not ceasing when they sold the land, I think that would be very wise.

Mr. LEMON: That is the question of apportionments.

Mr. GAMBLE: I know many cases where they sold the land and made the roads after a fashion. Afterwards the parties that bought the land had to reconstruct the roads and finish them at great cost.

Mr. JERRAM: The speaker before last thought he could not recover any of the money that was spent on the private roads. I think the decision of the Master of the Rolls was that a local authority could order any work to be done at any time and as often as you like, and recover the money; but unless all was done you could not dedicate. Then as regards the size of the sewer. It is of course a point whether a sewer shall only be sufficient for the houses to be drained or so made as to be useful for the district. That point I had before a Government inspector not long ago, and we showed a sewer large enough to take the drainage of the adjoining street. The matter was discussed, and the Government inspector, and the Local Government Board also, ruled that we could only put down to the owners the actual size of the sewer requisite for draining their street.

Mr. LEMON: That is provided for in the Act.

Mr. JERRAM: As to the dedication, there is a very simple way of getting over the difficulty, done in the midland counties and also in the south of London. The right people to make up the roads are the people who cut up the fields, and if you have your bye-laws so made that they must do everything that is required by the Public Health Act, you can then dedicate that road as a public highway, because the freeholders are only too glad to give the road up to the public authority. Then, if anything has to be done afterwards, the builders will have to comply with the regulations for breaking up the roads, and you will get your money in hand to

do the road afterwards, and will have no trouble at all with the 150th or 152nd section. That seems to me a very easy way of getting out of the difficulty. Where people are willing there is no difficulty about it. If there is any road in the district that you think ought to be taken over, send your men on and do the work. You may have your cantankerous ratepayer who will appear at the audit, but how is he to tell what the cost of repairing that road is?

Mr. J. HALL: I cannot see the great advantage that Mr. Jerram appears to imagine. If the owners of the streets do not want them taken over, the best plan is for them to keep them. Then, when they get out of repair, you give notice and charge them again. In my borough we have done something like 40,000*l.* worth of paving. In the whole of those streets there was only one exception where there was any objection to its being taken over, and that was adjoining a public house, a cul-de-sac, where they were afraid that the people would break a door into a private street and damage the property adjoining. I think it is quite competent, if a street is in a bad state of repair, for the local authority to put it into a good state of repair and charge the owners with it. And they are not compelled to take it as a public street, because it may be only partly built on. If the owners are agreeable, we put the street into order; and then, when it is built on, we put it into the usual state that our Act of Parliament allows us, and dedicate that street. We have found no difficulty in carrying it out. We have had cases before the courts, and I do not think we have lost a single halfpenny, and it has never been questioned whether these streets were dedicated or not. We never dedicate the streets till all the money is paid or the people agree, by a special form of agreement, to pay the money by instalments.

Mr. READ: I should like to ask why the objection of Mr. Bidder was not accepted within the time. It says in the paper that an objection was made, but not considered correct in form by the Board. What was the objection of the Board to that? The majority of owners would like a local board to take over a street.

Mr. ANGELL: The adjoining owners did not object; they wished the road to be dedicated. Neither did Mr. Bidder, who claimed the ownership of the soil, object. But a correspondence happened to pass with some one in Mr. Bidder's office, and he simply used this casual expression, "I don't think we shall agree to the dedication of the road"—nothing more.

Mr. READ: It seems to me that the action was brought upon one point, and the decision of the Master of the Rolls given on another; the decision of the Master of the Rolls was because the street was not levelled, and so on, according to the Act. I think most gentlemen will agree with me that private streets are the *bêtes noires* of surveyors. We have had some difficult cases in my town—streets that have been mere tracks for twenty years until the people became more fastidious and discovered they wanted better. They memorialised the Corporation to do something. Notices were served on the owners. Certain of these owners tried to do their own frontages with disastrous results. I fancy, myself, though it may not be correct law, that it would be a very good thing for surveyors if Mr. Angell's plan of obtaining the money beforehand could be applied to the original owners of estates; when a man lays out an estate, he makes the roads in a fashion and goes away rejoicing with the money for the land in his pocket, whereas the poor unfortunate people who have bought this land in single plots are let in to complete the road. The street is cut up by house building, even if in a good state of repair in the first instance. I should very much like to see a law made, something like the law of railway companies, to take the money first. The railway companies take care to make the private sidings themselves, and if the local boards could make all streets themselves both private and public it would be the better plan.

Mr. PARRY: I would like to know the authority on which they compelled the owners of the land to make up these streets.

Mr. JERRAM: In accordance with the bye-laws, sir. The Public Health Act says you may make bye-laws for the making up of a street.

Mr. PARRY: What is a "street"? You must wait till the buildings are erected. I don't think the bye-law is of any value.

Mr. ANGELL: There have been two decisions. But it is evidently law; every one must acquiesce in it. Of course we never saw it before, but it is obvious when you look at it carefully.

The PRESIDENT: In every one of these districts there seems to be a variety of modes in dealing with these cases, and some of us are obliged to do it outside the Act. If you can do it, it is a very fortunate thing. We get the money first in the majority of cases. We have not a clause, but we tell them that it will cost about two-thirds, if done by us, of what it would cost if it goes to public com-

petition. The contractor does not get a penny of his money till six months are over. Of course he puts on a corresponding interest, and those who choose to put us to this trouble and expense have to pay it. When we get the money first, we do the work ourselves as a rule; but in those cases where we are obliged to put it up to public competition in consequence of the money not being paid, we put in a clause that no money shall be paid for six months. There are a large number of things that spring out of this; but we have not the time now to enter upon further discussion—at the same time we cannot but feel that many things which have been referred to are exceedingly valuable. Probably if we have another opportunity of discussing this matter, which I have no doubt we shall have, considerable benefit will arise from it; because these thoughts will not be lost. They will be carried home, and probably some of our Boards will make use of them. If the amended Bill does not pass, I don't see why a clause should not be inserted giving power to get the money first as in the West Ham Bill. I cannot understand why the ratepayers should lie out of the money for a lengthened period to suit the convenience of those who don't choose to pay. I have the roads made complete—paved and kerbed and thoroughly made up. Objections are raised—"Why do you oblige me to kerb, when you know it will be pulled to pieces?" I say, "Because I can't help it; all I know is, I won't pass the road without." When the time comes for serving them with notice, there is very little to be done. The material is all there.

Mr. ANGELL: May I ask the President under what power he does this?

The PRESIDENT: I can't answer that question. Now, Mr. Smith, if you will be so good as to make your reply to these remarks. But previous to that I may make a special appeal to our friends to be here at eleven o'clock to-morrow morning. Mr. Hanson will be here with his machine for the treating of sewage by chemical means. And also we have asked Mr. Shoolbred—whose name is not down on the paper, but whose name is well known in connection with electric matters—we have asked him, only within the last few days, to read a paper, and he will be with us to take part in this struggle of gas and electricity.

Mr. SMITH: I don't think I need detain you but a very few moments. The matter has not been absolutely thoroughly thrashed out; but it has been ventilated very much to my satis-

faction. It is only during the last four or five years that I have been led to turn to these matters, and I must say that recently it has puzzled me considerably. The Commissioners that I represent have taken over roads which have been in a very satisfactory state. There has been nothing decided as to what state a road should be taken over in, and we have had complaints that we have dedicated roads not made up so handsomely as others. We have to thank Mr. Angell, I think, really, for the initiation of this matter. There is another important point with respect to finding funds. We have always been in arrears and sometimes nearly bankrupt through advancing money out of the rates and not getting it back afterwards. Now, though we are not able to get the money beforehand like Mr. Angell, or like Mr. Jones by moral suasion, we have tried another method. That is, to borrow the money in the same way as you do for a drainage loan. The only difficulty is this. The inspector comes down and says, "Now, I won't hold another inquiry till all the notices are served." We are going to spend about 18,000*l.* for roads, and we have no doubt that the inspector will recommend that the money be lent.

Mr. LEMON moved that the Bill be referred to the Council for their consideration and to take action thereon.

This was seconded, and carried unanimously.

The PRESIDENT: I think it falls to some gentleman here, or probably to myself, to thank Mr. Smith for the excellent paper he has given us to-day, and also inasmuch as it has created so interesting a discussion by providing really valuable matter. It is not altogether even the length of a paper, so much as that it shall be one upon which we may hang our thoughts and detail our experience. Therefore I propose that the thanks of this Association be given to Mr. Smith.

Carried unanimously.

ANNUAL MEETING IN LONDON,

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HANSON'S SEWAGE PROCESS AND PATENT AUTOMATIC MACHINE

Mr. HANSON, who was introduced by Mr. Lobley, said that for some time he had turned his attention to the treatment of sewage water. In order to meet the great difficulty in getting local boards and corporations to use machinery, especially if it had to be worked by gas or steam-power, or anything that would cost money, he had studied exhaustively the question of the efficiency of machinery, and as the result of his investigations he had invented the automatic machine, a model of which he now placed before the Members.

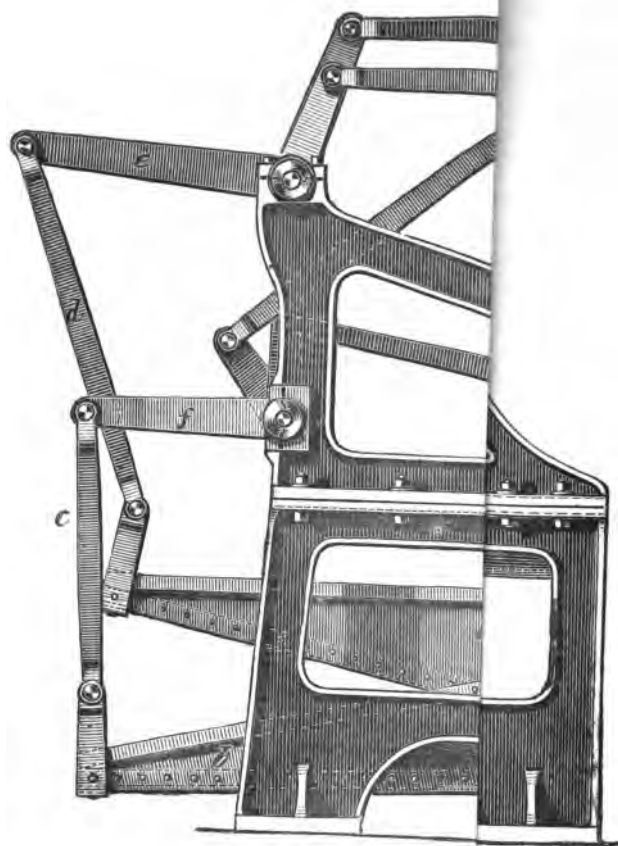
The following extract from *Iron*, dated March 31st, 1882, fully explained the details connected with the working of the apparatus:—

“The question of the purification and disposal of sewage has been tackled by a large number of engineers, chemists, and others, with a greater or less degree of success—more frequently less than greater. Amongst the few who have pursued the study of the matter to a successful issue is Mr. John Hanson, of the firm of John Hanson and Co., of the Victoria Chemical Works, Wakefield. Mr. Hanson's treatment consists in the use of lime and black-ash waste as purifiers, and his system has been in use at Tong, near Bradford, for about four years with every success. It is also in use at other places, notably at Golcar, near Huddersfield, where the works were designed by Mr. Hanson, and were started near the close of last year. The objection to lime alone, as stated by Mr. Hanson, is that lime alone does not remove the germs of infection, whereas with the addition of black-ash waste the water is so effectually purified that, according to a report of the Constable of the Tweed Commissioners, salmon fry and other delicate fish

can live in the purified water. The black-ash waste is a by-product from alkali works. According to Professor Roscoe, for every ton of soda ash produced, from $1\frac{1}{2}$ to 2 tons of waste are formed and it accumulates in enormous quantities. This waste contains the whole of the sulphur burnt in the pyrites kiln, amounting to from 15 to 20 per cent. of the weight of the waste. The purifying properties of black-ash waste are as follows:—Black-ash waste as it comes out of the vat contains all the sulphur which was used in the making of the soda ash. It is then in the form of insoluble mono-sulphide of calcium. When the mono-sulphide of calcium is exposed to the action of the atmosphere it passes into a higher state of oxidation, then called soluble di-sulphide of calcium. When this soluble di-sulphide of calcium is brought into contact with caustic lime, after both have been added to the sewage, then the di-sulphide of calcium contained in the black ash reacts upon the free caustic lime which is held in solution, and precipitates both in the form of mono-sulphide and sulphate, carrying down with them all the sewage impurities, thus discharging the effluent neutral and pure into the stream. By means of lime alone this is stated to be impossible. The two deodorizers are well stirred in the cistern by agitators, worked by a small gas engine. Into the lime cistern water is introduced to produce the necessary paste, and into the other the sewage runs by gravitation, and thus the effluent of each is a diluted fluid which is conducted into mixing and settling tanks. The tanks are emptied occasionally, the residuum being removed for use as a manure.

“We have thus fully explained Mr. Hanson's process, in the first place because it is reported to be most successful with very foul sewage, and, in the second, because the precipitating and purifying materials play an important part in connection with the machine illustrated in the annexed engraving, a working model of which we recently saw in operation at Messrs. Hanson's works at Wakefield. This operation is Mr. Hanson's automatic sewage machine, and we understand that one has already been ordered for Golcar, and it is anticipated that Tong will follow suit. The chief feature of this machine is that it is worked by the sewage which is to be subjected to treatment, thereby avoiding the expense of skilled labour and fuel. Assuming the main sewer to be arrested, as it were, by this machine, its contents flow into a reservoir provided with a set of rollers, which convert the lime and black ash to form the precipitate into a pulp. This is discharged into two trough levers beneath, which form the motive power for





setting the whole machine in motion. A sufficient quantity of sewage having gone into one or the other of these troughs, it goes down, discharges its contents charged with the precipitating material, and in the action turns all the machinery that has ground the black ash and lime, and even registers the number of gallons of sewage that have passed. The invention is very simple. Every crank and lever is set in motion by one fall of the troughs, and it has not a wheel in it. Mr. Hanson calculates that for 500*l*. such a machine could be erected which would clear the sewage of a town of 10,000 inhabitants. Of course the great idea of treating sewage is to introduce the precipitating elements, to make it, in fact, innocuous; but this hitherto has only been effected at a great expense. Mr. Hanson's machine promises to make this a very simple matter.

"It will no doubt occur to some that as the sewage is purer at night than during the day, the addition of the purifying material during the former period is so much waste. So thought Mr. Hanson, and he has devised an automatic arrangement whereby, as the sewage becomes purer, so the supply of purifying material is cut off until it ceases entirely. As the sewage becomes gradually foul in the morning, the supply of the chemicals commences and continues. The mixture of sewage and chemicals will be led from the water levers into a series of settling tanks, and will be dealt with in the same way as in the Hanson process at Tong."

The accompanying engraving represents a side elevation of the apparatus. *a* and *b* are the water levers; when one is full of sewage water, the lever drops and the empty lever rises, giving motive power to *c* and *d*, which are rods connected with *e* and *f*, and to the whole of the machine. The rods *g* and *h* are connected to sluices from which flow alternately the sewage water, numbers 1 and 2, *a* and *b*. There is a lever bar *i* working the back part of the machine. The hopper *j* contains the black-ash waste and lime or other chemicals for purifying purposes. A slide *k* is regulated to supply from *j* the given quantity of chemicals required to purify the quantity of sewage water contained in *a* or *b*. An indicator *l*, is for registering the number of gallons of sewage water that pass through the machine; the chemicals fall through the tube *m* amongst the grinding rollers *n*, by which they are crushed. The rollers are pulled forward by the lever *o*, and backward by the lever *p*. A sewage pipe *q* conducts the water to the sluice valve *r*. The water levers, *a* and *b*, turn on a fulcrum-rod *s*; at *t* is seen the sewage water falling into the water levers.

DISCUSSION.

Mr. HANSON in reply to a question said that for a population of 300,000 as at Leeds, three machines would be required.

Mr. McKIE: I have found that it is a very difficult thing to arrange that every portion of sewage should receive its proper proportion of chemicals; for at one part of the day you require a greater portion than at another. In the refuse from indiarubber works no amount of chemicals would purify.

Mr. HANSON: That I have arranged for, the quantity of water may be always alike.

Mr. McKIE: Yes, but not always of the same strength.

Mr. HANSON: No. That I have arranged for, and I do it by galvanism. I have a place here where I can have three hydrometers, and if the water is something like almost pure early in the morning, not much sewage water in it, it may stand at figure 1. It just rises and comes in contact with the battery and allows this to open one quarter. Later in the day it rises perhaps to 2 or 3, and then it touches the battery again.

Mr. McKIE: What does your hydrometer prove?

Mr. HANSON: The specific gravity.

Mr. McKIE: Only that. With chemicals no specific gravity would tell you what to put in.

Mr. HANSON: The object of this machine is to find its own power. There is no steam power required. I have no doubt in time that that difficulty will be got over. If there are certain impurities in water which specific gravity will not show, we must have some other means. I have found in my experience of tanyard water that it is a very difficult water to deal with. Whatever quantity you put in you will only make things worse—that there are only certain things you can apply to the tanyard water to make the colour better. But innocuous colour can go into the stream.

Mr. SMITH: You say it requires three machines for 300,000 people. With a population of 100,000, what would be the capacity of one of the hoppers?

Mr. HANSON: The hopper would contain about 5 cwt. of lime, or, if it is used with black-ash waste, would contain about 1 cwt. of black ash.

Several members of the Association put questions as to the model and on points of detail, and were answered by the inventor.

The PRESIDENT: The explanation which Mr. Hanson has given of his exceedingly interesting machine I am sure must be particularly useful, and I hope it will bear its results. I have no doubt it will. It is a matter in which many of us are peculiarly interested, not only those who are here at the present moment, for in London we cannot get the gatherings that we do in the northern district; but whatever takes place here will be known throughout the length and breadth of England. I cannot commence the ordinary proceedings of the meeting without asking you to record a cordial vote of thanks to Mr. Hanson, who is here by our invitation, and has taken some trouble and been at some expense in order to show the members who are here the working of this particularly interesting machine. I have much pleasure from the chair in proposing a vote of thanks to Mr. Hanson.

Carried unanimously.

ANNUAL MEETING IN LONDON,

June 29, 30, and July 1, 1882.



GAS AS AN ILLUMINATING AGENT COMPARED WITH ELECTRICITY.

By W. SUGG, Assoc. Inst. C.E.

Public attention has now during the past four years been directed very strongly towards the important subject of interior and exterior lighting, principally through the efforts of the various electric lighting companies to substitute their systems in the place of gas. Previously to the advent of the electric system of Jablochkoff in the Avenue de l'Opéra, in Paris, the practice which was mostly observed in municipal and parochial lighting, as well as in the lighting of railway stations and other large spaces, was to reduce as much as possible the amount of gas consumed, and to divide that amongst a multiplicity of small lights. Improvements in the construction of the burners used in lighting such places were in many cases neutralised, so far as improved lighting was concerned, by a reduction in the quantity of gas used in each lamp, so as to produce the same light as before, and save the gas. Thus, previous to about the year 1862, the street lamp and other burners were almost all made of iron or metal, and were so constructed as to require a pressure of at least eight-tenths of an inch of water to make them pass 5 cubic feet per hour (the ordinary contract quantity for common gas).

The introduction of steatite flat-flame burners of an improved construction, together with the simultaneous invention of street-lamp governors, as nearly as possible doubled the illuminating power of each lamp; that is to say, one of the old 5-foot iron burners only gave the light of six parliamentary candles for that quantity of gas. The new steatite burners and governors which replaced them produced from 12 to 12½ candles for the same con-

sumption. The gas at that time was such as would give 14-candle light when consumed in an Argand burner consuming 5 cubic feet per hour.

In a great many cases where the new burners were employed the quantity of gas consumed was reduced simultaneously with the adoption of the new burners. No amount of improvement in burners would, under these conditions, have secured a better lighting, although they would have saved gas.

In the lighting of private houses it appears to have been an accepted idea that anything in the shape of a burner would yield the same amount of light for a like consumption of gas. Consequently, if the gas bill were complained of, the gasfitter, or even the gas company's inspector in some cases, anxious to do the best possible for the customer, put on smaller burners all over the house, expecting that the consumption would be reduced. But in any place where there was a good pressure the result was exactly the contrary. The reason of this was that the gas being consumed under a higher pressure at the point of ignition than before, could not, for want of sufficient time, combine with the oxygen of the atmosphere, and so attain a high degree of incandescence; but it was blown through the burner as it were through a blowpipe, producing heat but not light. Although the state of things has been improving from that time, yet the old state of gas lighting remains still far too general for me to be able to dismiss this view of the matter from my paper.

The grand principle to consider in our plans for both public and private lighting by any artificial means whatever is that artificial lighting should be, and must be, if success is to be obtained, *a prolongation of the light of day*. Now the light of day is of various qualities according to the hour of the day and the time of the year. In order to illustrate clearly to you the difference, the author would call attention to the diagram of the solar spectrum. [*Diagram exhibited*]. We are indebted very largely to the labour of Professor Tyndall for our knowledge of the composition of light, and he has by his patient research discovered and shown to us a great number of facts in relation to light and heat, of which we had before no idea. Thus, for example, we see that at each end of the solar spectrum there is a dark mass, which represents those component rays of light which are invisible to our organs of sight. Yet Professor Tyndall has proved that under certain conditions many of those rays nearer to the violet rays are visible to our sight.

That mass nearest the red ray, which is in volume a mountain in comparison to the rest of the rays, represents the heat rays; these rays move with so little comparative velocity that they do not produce, as far as we know at present, any perceptible effect on our optic nerves. They are, at the same time, the least refrangible of the rays of light, and therefore pass through a prism or a molecule of water in the atmosphere, with the least possible divergence from its course, in fact, almost in a straight line. The speed of vibration or motion goes on increasing as we near the deep red rays, and at length we become sensible of what we call light. Increasing in speed the vibrations next produce upon our organs of sight the effect of orange, then with a further increase of rapidity we perceive the yellow ray, and so it goes on, with each increase of motion the divergence from the straight course is increased, and we become conscious of the green, blue, and violet rays. At this point the retina of the eye, we are told by Professor Tyndall, is struck 789 million times in a single second, and ceases therefore to be an organ of vision. But beyond this violet ray there is yet a large number of rays which to us are usually invisible, and only slightly visible, as Professor Tyndall has discovered, when they fall upon specially prepared surfaces.

But these invisible rays exercise a very important effect upon all organic substances. It is to their decomposing influence on the various preparations of silver and other salts that we obtain photographic views and portraits. The visible rays, such as the red and yellow, exercise generally no decomposing effect upon the preparation of silver.

The green and blue and violet each exercise a greater degree of influence on these salts in the order in which they are mentioned, but the greatest effect by far is produced by the invisible rays at this end of the solar spectrum. These rays move with the highest velocity, and are the most refrangible of all the rays. They are called the actinic or chemical rays, and it is probable that the mountain of heat rays at the red end of the solar spectrum is balanced by an equally immense mountain of actinic invisible rays at the violet end. But we know certainly that the volume of these actinic rays in the light of day varies very much indeed at different times of the day in different seasons of the year, and we have a very good measure of this in the practise of photography. Thus, on a fine day in summer the early morning rays are roseate in colour, verging on the yellow, and the heat rays, dark red, orange,

and yellow, are largely represented in the composition of the light. The other rays are practically absent or only nominally represented. This quality of light is therefore, though sufficiently powerful for all kinds of outdoor work, and for reading and writing within doors, extremely pleasant and grateful to our organs of vision.

But as the day wears on the composition of the light changes, the heat rays increase in volume, and all the more refrangible and rapidly-moving rays become more and more largely represented in the composition of the light, till at noon the highest effect of every ray is given in the glory of the day. But this magnificent volume of light has vast functions to fulfil, entirely independent of the ordinary duty of enabling us to see what we are doing; and therefore for the purpose of work and for reading and writing, we cut off a large portion of it, by means of blinds and various other devices, and reduce it to something which is more in accordance with the strength of our visual organs. By this means we very much reduce the volume of the actinic rays. In sitting rooms generally, except with specially prepared plates, a photograph could not be obtained. More than this, the actinic or chemical rays, and their neighbours the violet and blue rays, which evidently serve very little for reading and working, are then also in their fullest power; and we know this because a prepared photographic plate which will take a view at midday with the exposure of the tenth part of a second, would, in the early morn with the same apparatus and lens, require from say 1200 to 600 times the exposure, according to the hour at which we take the view. But after noon nature provides that there should be a gradual but comparatively rapid decrease in the power of these high velocity and highly refrangible rays, and at eventide we have a soft, mellow light, exceedingly agreeable to our sight, composed of the low velocity rays, and with so little of the chemical rays that the same kind of photographic plate which produced a vigorous photograph with one-tenth of a second's exposure will now, with the same apparatus, only produce a mere ghost of a picture with any amount of exposure. And yet we have a strong light suitable for all outdoor and indoor work, and this quality of light is then that which it is the aim of all who study and practise artificial lighting to produce. Anything which goes beyond or falls short of this is not a prolongation of the day, but an abnormal and imperfect attempt at artificial illumination which cannot give satisfaction, and is certain to affect prejudicially our visual organs, which are so

infinitely precious to us, but which are in these days destroyed in the most barbarous manner by the constant use of defective means of artificial illumination.

In contemplating the too frequently defective means and unscientific manner of using those means of artificial light in private schools and colleges, and which the young are compelled to make use of in these high-pressure days of education, the author earnestly wishes that the learned professors and heads of colleges would add one more little item to their own attainments, and learn how to teach the young to preserve their sight, so that they may, at least till they reach the middle period of life, enjoy without the help of spectacles the full benefit of the knowledge the professors have imparted to them with so much pains and self-sacrifice.

It has become a fashion to believe (through the persistent assertion of electricians) that gas consumed in a burner of any kind cannot fulfil the proper conditions of artificial illumination either for the lighting of private rooms, halls, open spaces, theatres, railway stations, or public streets. But on the contrary, the electric light in some of its forms, either arc or incandescent, according as the electrician is an arc man or an incandescent man, or both, is, they say, to be the light of the future, and we gas men are invited to consider our ways and take to roasting turkeys and cooking pies and tarts till such time as the coming power shall have time to come down into the kitchen and take up that work as well as everything else. We are told that if we convert our gas into motive force and drive a gas-engine with it, we shall produce a light in electricity much greater and better than we can get out of it if burnt in a burner to produce light without the intervention of the electric machinery. Be this as it may, the advice is good, and we shall roast the turkeys, and cook the pastry, and drive engines by gas; but we shall also stick to lighting by gas as well.

But no amount of assertion, scientific or otherwise, will make any difference to the issue. The world is to be lighted and it must be done by some means or another, be it candles, gas, oil lamps, or electricity—probably by all. But that method which approaches nearest to the conditions alluded to and produces a prolongation of daylight is the method which must have the greatest success. And the author will bring before you some instances of gas lighting that will prove to you that gas can approach, when properly used, to the composition of natural light.

For example, for the purposes of interior lighting of large spaces, such as halls, theatres, museums, &c., gas can be used as in the House of Commons Parliament Chamber. Here the gas lighting is done from the ceiling, which is of ground glass, in large squares of 3 feet in diameter. Each of these squares is so fitted into its frame that a space of about an inch is left nearly all round it between the glass and the frame. Above each glass is a kind of hopper-shaped reflector under which a burner of the Argand form is placed, and the light is reflected down through the ground glass into the house. There are 64 Argand burners, consuming 1100 cubic feet of 21-candle gas per hour—light equal to nearly 4000 candles. In the centre of each square of glass is painted a red rose. The light thus diffused all over the chamber is of a soft and exceedingly agreeable character, because it is largely composed of the yellow and rose-coloured rays, and has a minimum of the blue and violet rays. Without such a light the long sittings of the House of Commons would be unendurable.

Yet this light was declared to be obsolete, and the House was moved to order a trial of the electric light. One of the most prominent of these lights of the future was accordingly introduced, and after a variety of experiments, which went the length of pulling out parts of the ceiling and lowering a number of square, not very æsthetic-looking lamps into the chamber, it was discovered that electricity could not fulfil the conditions of artificial lighting so well as the gas, and accordingly the experimenters removed their apparatus, and gas now again lights the House of Commons. The lighting of the House of Commons is done without in any degree vitiating or heating the atmosphere of the house. So far from vitiating the air, the heat of the combustion of the gas is utilised to assist in the ventilation of the house by inducing a current of air up the ventilators, which are in connection with each burner, and thus carry off all the heated air from the interior of the roof. The lighting of the Parliament Chamber of the House of Commons resembles the summer evening light of which the author has spoken, and yet there are some who have declared that it is not so.

Till a short time since it was not possible to confute these critics, who could see no good to come from gas; but the opening of the new Reading Town Hall on the 31st of May last clearly showed that the "prolongation of daylight" can be realised by the proper use of gas. This hall, which is about three times the size of the House of Commons, and the cross-section of which is before you,

has been designed in such a way as to admit of the daylight and gaslight coming through the same openings, and thus the exact effect of the two could easily be ascertained. The hall is lighted by means of a glass cove, which runs all round the hall. Above the cove are the skylights in the roof through which the daylight descends into the hall. The cove is fitted with ground glass, upon which a light-coloured design in transparent colours is worked. Behind the glass cove are fixed the gas burners which consist of combinations of four large flat-flame burners giving a light of 120 candles each combination. There are 71 combination burners. Total consumption of gas per hour, full lighting, 2300 cubic feet of 16-candle gas. The total volume of light for the hall amounts to about 9000 candles.

The following experiment, having for its object to ascertain the difference between the natural and artificial lighting of this hall, was tried on the evening of the 31st May last. A grand concert was given by the municipal authorities which commenced at 7.30 P.M. At that time it was broad daylight, and the hall was well lighted by the evening light above referred to. The gas lights were turned full on at the commencement of the concert, and were not interfered with throughout the evening; these did not of course perceptibly increase the daylight when they were lighted, or, in fact, make any difference to the light in any way. But as the light of day faded away they took up the lighting, and so imperceptibly did the artificial light replace the natural light of day, that late on in the evening, when it had become quite dark outside, the audience imagined they were still sitting in daylight. The only adverse criticism on the lighting was by a gentleman connected with architecture, who gave it as his opinion that the gas lighting was a failure because it was so exactly like daylight. This experiment has been repeated again lately with similar results, and it is put before you as a proof that gas lighting, when properly applied, is a prolongation of daylight. No heat or products of combustion are thus permitted to enter this hall; but, as in the lighting of the House of Commons, each burner is provided with a separate ventilator, which carries off not only the products of combustion, but all heated air from the roof.

From these examples of artificial interior lighting by gas, in which the lighting agent is placed outside the chamber, and which of course admits of many variations to meet the requirements of picture galleries, valuable libraries, &c., the author passes to the

lighting of the House of Lords. In this instance the gas is consumed through what are called Faraday's burners, and these, the invention of Professor Faraday, are combinations of fish-tail burners so arranged that each flame shall heat the air between it and the next, producing a brilliant white light. Each burner is provided with a separate ventilating flue, and at a certain distance up this flue a small Argand burner, fitted with a copper cylinder, is fixed, which induces a sharp upward current in the flue, and carries off not only the products of combustion, but the vitiated air of the Chamber of Lords also. Here the gas is employed as a means of lighting as well as of ventilation, for without the heat of the burning gas, mechanical means must here have been employed to carry off the vitiated air of the room. This lighting is a brilliant lighting, but not of that soft daylight character which the system employed in the Parliament Chamber enables us to realise.

Many modifications can be made in the combined system of lighting and ventilation to make it suitable to a variety of requirements. Here the author would touch upon the lighting of the auditorium of the Savoy Theatre by incandescent electric lights. In this instance the lights are placed round the auditorium immediately under the circle in which the audience are seated, and who have consequently to look over them. The heat from these lamps, contained in an hermetically sealed glass chamber, radiates in every direction from the lamps, but they cannot in any way assist the ventilation. On the contrary, the means of ventilation, which are very carefully carried out by the architect so as to supply fresh air taken from above the roof of the theatre, are rendered ineffective when the incandescent lamps are being used for lighting by themselves, and it is therefore necessary to make the ventilation in some degree to act by keeping the sun-burner, which lights and ventilates at the same time, alight, so as to promote an upward current to carry off the vitiated atmosphere, and bring into play the fresh-air apparatus designed by the architect. Of course, by placing gas-burners in the ventilating shafts of the sun-burner, it is easy to induce an upward current, and in that case the heat from the electric lamps and from the audience can be carried off, and the entrance of fresh air induced without lighting the sun-burner. But it may appear to practical men that a much more simple and effective way would be to let the sun-burner do the lighting and ventilation at the same time, as in the Peers' Chamber. This has a direct bearing upon the question of ventila-

tion, and is referred to not as a criticism upon the lighting of the theatre by electricity itself.

For examples of lighting large spaces, such as railway stations, goods stations, &c., there are at least two railway stations, viz. the Derby and the Carlisle stations, which have been lighted with gas on improved systems; and in point of volume of light, perfect control, steadiness, and efficiency there is no other system of lighting which surpasses them. At Derby the cost per annum of the improved gas lighting does not exceed that of the old lighting, which only gave about one-third of the light which is now obtained from the new lighting. One remarkable feature of this lighting by gas is the entire absence of troublesome shadows which are so apt to disturb the minds of travellers with only a limited amount of time in which to find their places, luggage, &c.

Here again the author would remark that previous to the advent of electric lighting, economy in the lighting of railway stations was pushed to the extreme, and the sudden change from the dim religious light of the silent station before the trains run in to the blaze of light which now dazzles even the solitary traveller who at Charing Cross or Cannon Street awaits the late-at-night suburban train is something the general public have to be thankful for.

But although in lighting these and other railway stations we should not waste gas on the deserted station, we should with great ease be able to produce a perfectly shadowless, abundant, and cheap lighting, without the discomforting appearance of flying shadows, which resemble nothing so much as an army of blackbeetles rushing across the platform whenever a little steam or the heat from the funnel gets in the line of the rays from an electric light. By a very simple arrangement called a bye-pass it would be easy for us to change a powerful lamp into a small light just suited to light the place when neither trains nor passengers were on the platform. For the lighting of docks and dock entrances there are suitable arrangements of reflecting lamps of from 150 to 500 effective candle power, which, by the same arrangement as just mentioned, can be reduced by a turn of the hand from their full power down to half-power, one-third power, 10-candle power, or one rushlight-power, with the important economic result of a proportionate reduction in the cost.

Thus, a large ship arrives at the mouth of the dock. At once, without any preparation, the captain of the dock, or the nearest labourer, turns on the entrance lamps full power, and the flash-light left burning lights them up to 500-candle power each simul-

taneously. A broad flood of shadowless light is thus thrown all over the surroundings of the dock entrance. At the same instant a row of smaller lights of 150-candle power are as rapidly produced from ordinary 5 feet per hour burners, which burn only at that rate when there is no need for a greater light. The ship is docked by this means, and with the same facility by night as by day, at a mere nominal cost in comparison with the work performed. There are also, now, means by which gas can be laid on to a ship in dock, and lamps of 150-candle power constructed to throw a powerfully concentrated light down the hold as well as all around the ship. These can be hung at three or four different points in the rigging, so as to permit of the unloading a ship during the night. This kind of work is now required by the new large fast steamers which are discharged and loaded again as soon as they arrive, without the delay of an hour.

In the matter of street lighting and the lighting of open spaces, such as squares, the very extensive display of The Gaslight and Coke Company from Westminster Bridge along the line of Whitehall, Trafalgar Square, Cockspur Street, the Strand, the Temple, and Fleet Street, as far as Farringdon Street; the line of Holborn from the Viaduct to Newgate Street, as well as the great number of refuges and squares lighted by the improved system of gas lighting, will sufficiently prove that gas is able to do street lighting with excellent results. Here again gas is not wasted in doing this powerful lighting when a much less light will do. After midnight either each lamp is reduced by the simple turning off a tap, to the rate of 5 cubic feet per hour—or 4 feet per hour, whichever of these quantities is adopted as a standard consumption—or, as in Whitehall, the large refuge lamps alone are left to do the work, assisted by one or two of the side-walk lamps in places where there is no refuge lamp to do it. This latter the author considers the best plan.

Thus a very excellent light of great volume and steadiness and of uniform illuminating power in any direction round the lamp post is obtained. It is safely distributed, so that if anything should happen to one lamp there will still be a sufficient number left to render such an accident of trifling importance. The colour of the light is agreeable to the eye, and its cost is not more than little over three times that of the old 5 feet per hour ineffective light. It is, in fact, about eight times the amount of light for three times the cost of the old lighting.

It is necessary to observe also that this improved lighting is managed by an ordinary staff of lamplighters, who for the most part are not even mechanics, except in that sense in which a jobbing shoemaker, or a tailor or a barber may be said to be mechanics. If, in future years (as the science of gas lighting progresses, and as the general public become better acquainted with its proper use) a new and improved set of lamplighters are employed, then it will be possible to obtain a far better result from the gas which is consumed in the public lamps by the employment of more scientifically constructed burners. But at present the most scientific gas lighting has to be tended by men who, as described by one of the most energetic of railway general managers, have "fingers which are all thumbs." Up to this time neither gas companies on the one hand, nor municipal or railway authorities on the other hand, see their way to allow of any other class of attendants for improved gas lighting, and so the field of progress in gas lighting is very much circumscribed.

The following table gives the illuminating power of the different kinds of gas-lamps used in various parts of London, tested *in situ* by means of the photometer which is now exhibited. Some of the lamps are side-walk lamps, and the larger ones are all refuge lamps. The lamps are all types of the principal kinds used in London and the provinces.

ILLUMINATING POWER OF DIFFERENT GAS-LAMPS, REFUGE AND SIDE-WALK, AS BURNING IN THE PUBLIC STREETS, JUNE 1882.

No.	Horizontal Distance.		Vertical Height.		Actual Distance.		Angle of Rays of Light.	Result.	Time.	
	ft.	in.	ft.	in.	ft.	in.			h.	m.
1	44	11	15	4	47	7	19	501.4	10	35
2	22	0	9	0	23	9	23	125.3	10	50
3	42	4	12	10	44	4	17	436.0	11	40
4	27	4	10	3	29	2	21	188.0	10	55
5	28	1	10	0	29	8	20	195.0	10	58
6	38	5	15	6	41	5	19	380.0	11	40
7	42	6	15	6	45	4	20	456.0	11	10
8	30	8	8	6	31	9	16	224.4	11	30
9	37	3	14	0	39	9	22	350.3	11	33
10	36	9	12	9	38	9	19	290.0	11	48
11	29	6	12	9	32	3	23	232.0	11	50
12	20	10	8	9	22	7	23	113.2	11	58
13	29	7	11	6	31	10	22	224.6	12	4

NOTE.—The standard was two candles 3 feet from disc, height of disc from ground 3 feet.

The photometer is so arranged that it may with ease be transported from place to place, and it can be used either to determine the amount of light in parliamentary candles falling upon any particular space, or the total illuminating power of any lamp, either gas or electric, as it is working in the streets. It is an arrangement of the Bunsen photometer, and the standard of light used as measurement is a Keate's standard lamp provided with what is known as a Methven slit, which cuts off all the light excepting that equal to two parliamentary candles. This is the amount of light which passes through the slit, and it is found to remain practically constant. The light from the standard lamp is allowed to fall on one side of a paper disc shaped like the letter A, and the other side receives the light from the lamp under examination.

The diagram shows how it is employed, and when it has been brought sufficiently near to the lamp to equalise the light on each side of the disc the measures of distance are taken. The calculation, according to the well-known formula, is simply as the squares of the distances between the standard lamp and the lamp under examination divided the one by the other.

In the field of domestic lighting gas suffers from its friends very much. In most cases the gas-fittings are put up by speculating builders and gasfitters, to whom gas lighting is an art or mystery which they have never been apprenticed to, and about which they know literally nothing. But improvement in this direction goes on rapidly, and there are many sorts of ventilating and non-ventilating gas-lighting apparatus which are too numerous to come within the limits of this paper.

Suffice it to say, that in most cases the only complaint against gas lighting in rooms is that it produces dirt and heat. There are also some who speak of its impurity. Now, whatever may be said as to the heat and products of combustion, it is certain that those who complain of such gas as is supplied all over London, and even country towns, on the score of purity, know very little about it. The gas which is consumed in these places is mostly composed of hydrogen and marsh gas, with a very small percentage of oxide of carbon and a variable quantity, according to whether it is cannel or common gas, of about from 8 to 10 per cent. of carbon. There is no ammonia, and no sulphuretted hydrogen present in the gas at any time, nor are there any impurities except a very small trace of sulphur in the form of carbon disulphide,

amounting to about from 8 to 12 grains per 100 cubic feet of gas. This can only be found by a most elaborate chemical analysis. The consumer is not cognizant of its presence. This has been proved by no less an authority than Dr. Odling. But there is sometimes a smell which results from imperfectly consumed gas in leaky or defective burners in close rooms which is mistaken for a smell of sulphur.

As no other material for artificial illumination is ever tested for sulphur, it is impossible to say how much of this and other impurities may be found in them; but it is reasonable to suppose that as sulphuric acid is largely employed in oil refining, that some free sulphuric acid must be left in all purified oils. It is remarkable that the copper springs of oil lamps usually turn green after use, which leads me to assume that some acid remains in the oil.

It must also be borne in mind that when gas is used in rooms it is always used in much greater volume of light than in those rooms lighted by oil or candles. As for example, two candles or a moderator or paraffin lamp are used if there is no gas; but if there is gas, a three-light or even six-light gasalier is lighted up, each burner consuming in many cases as much as 8 feet per hour. If a better class burner is employed, with 5 feet per hour, such a room is lighted with a volume of light equal to, at the lowest estimate, from 30 to 60 candles. The need of ventilation in these rooms is obvious. Well-lighted rooms must be well ventilated, no matter what system of lighting is adopted. Heat will be generated wherever lights are used, unless the lights are made as gas lights can now be made, to take their supply of air from outside by means of an annular shaft round a central one, which carries off the heat and products of combustion, as in this diagram.

A very small billiard-room lighted in this manner, at the Raleigh Club, Regent Street, does not obtain from the lighting an increase of temperature of more than one degree. The billiard lights are equal to about 400 candles. Such a light as this is suitable for conservatories and libraries, as no products or heat can vitiate the air of the room.

As to smoke and dirt, the author has shown several systems by which that arising from the gas can be prevented from affecting rooms in which it is used. But till the smoke and fog of London and large towns are cured, it is no use to expect an entire absence of dirt where gas is burnt in open globes. Every gas-burner throws

up a column of heated air to the ceiling; fog, smoke, and dust are thrown up with it. Improvements in the use of gas are constantly going on, however, and the great competition that there is in this system of lighting will be sure to make the march of improvement more rapid. But as the state of the science of gas lighting is at present, the systems which have been pointed out are all of them practicable, have been thoroughly proved, and will realise the advantages claimed for them.

There are later improvements not so thoroughly tried, such as the Clamond incandescent gas-burner; the principle of which is to burn a mixture of ordinary coal-gas mixed with air on the surface of a small basket made of magnesia. The basket is about two inches high, in the form of an old-fashioned strawberry punnet. The diameter of it at the base is about $\frac{3}{4}$ of an inch, and at the top it is about $\frac{3}{8}$ of an inch. When burning it gives a very white light from a radiating surface of about an inch square of incandescent magnesia. The volume of light given is equal to about 40 candles, and the consumption of gas is very moderate. The amount of light per cubic foot of gas made is said to be from 5 to 6 candles.

There is also another platinum incandescent burner, made by Mr. Lewis, which gives a very pure kind of light, rather more yellow than the Clamond burner. The principal difference between the two is that on M. Clamond's system the air is heated before it enters into combustion with the gas; on Mr. Lewis's system the air is not heated excepting in so far as it can be heated in passing up the tube on the end of which the platinum bracket is fixed.

Now on the subject of incandescent lights it cannot have escaped your attention that every ordinary gas light is an incandescent light. In fact, the light from every gas-burner is produced by the incandescence of carbon promoted by the combination of the oxygen of the atmosphere with the hydrogen and marsh gas, which are the principal elements of the ordinary gas of commerce. The difference between a gas-burner and an incandescent electric lamp is simply this: that in the case of the ordinary gas-burner the carbon is consumed and converted into carbonic acid; in the case of the electric lamp the carbon being enclosed in a glass vessel from which as much as possible of the atmospheric air has been exhausted, it does not burn away so rapidly, but may last for a long time or a very short time according as the vacuum is maintained nearly perfect or the reverse. But in both cases there is a certain

amount of heat given off, the most by the burning gas. In the case of the gas the steam which is formed during combustion carries the greater part of the heat with it up to the ceiling, where it may be taken off by ventilation. In the case of the electricity it is dry heat which is given off.

The author has only so far dealt with the consideration of gas as a means of lighting, and the space left for the comparison of electricity with gas is of necessity very short. But all through this paper there is a comparison of gas with electricity, and the author has shown a certain number of systems of gas lighting intended to illustrate the principal modes in which gas can be used so as to obtain, if not a perfect artificial lighting, yet a very useful and satisfactory lighting. In all of these there are the advantages of readiness, steadiness, and reliability. Great volume of light comparatively free from those highly refrangible and rapidly moving rays which irritate the visual organs and render them to a certain degree insensitive, and absence of hard shadows. In fact, as has been proved to you, a light which is of the same quality as daylight, which can be reduced from a powerful light to the most infinitesimally small light at will, and which, when reduced in power, is reduced in cost also. Facility of transport to considerable distances from the source of supply practically without loss; facility of use when required, and facility of extinction with resulting economy of cost. Production in any required quantity during the whole of the twenty-four hours of the day with great facility of storage, and distribution at any time of the day or night when required. These are some of the advantages of the use of gas as an illuminant.

The author has left out of the question the consideration of cost, because, until we are somewhat agreed as to what is an electric horse-power, and what is an electric candle-power, and a variety of other important questions, no proper comparison of the two systems is possible on that score.

Again, the method of photometry practised by the electricians is totally distinct from that which we employ in measuring the illuminating value of gas. Thus, for example, the above table gave the illuminating power of various gas-lamps as they are working in the public streets. The following is a table of about as many electric-lamps, taken with the same instrument and the same standard on two different nights. Both nights were fine and clear.

ILLUMINATING POWER OF ELECTRIC-LAMPS TESTED IN SITU, JUNE 1882.

First Night.

No.	Position.	Horizontal Distance.	Vertical Height.	Actual Distance.	Size of Gas Lamp calculated to produce the same Result.	Time.
		ft. in.	ft. in.	ft. in.	candles.	h. m.
1	Lamp on kerb under Waterloo Bridge	26 3	8 4	27 7	169·0	10 25
2	First post, Somerset House	34 3	13 0	36 8	297·0	10 35
3	Same, with violet rays ..	35 6	32 3	34 10	269·0	10 39
	medium	29 0				
4	First post, Temple Station from Westminster (lamps went out)	31 3	13 0	33 6	249·0	10 45
5	First post, Temple Library	31 10½	13 0	34 3	259·0	10 55
6	Second post from Blackfriars Bridge towards Westminster	31 9	13 0	34 1	258·2	11 5
7	At Refuge (Brush), Blackfriars Bridge	48 8	47 6	50 6	557·2	11 15
	.. ..	46 3				
8	In front of Times Office ..	81 0	80 6	81 3	1466·6	11 25
	Same, side	80 0				
9	Corner, Ludgate Station..	29 7	11 10	31 6	120·4	11 50
10	Brush, corner of Bride Lane, with photometer down lane	50 0	11 6	51 3	582·4	11 55
11	Do., with photometer towards bridge	39 0	11 6	40 4	320·8	12 0
12	Do., with photometer across road	33 0	11 6	34 9	267·4	12 5

Second Night.

1	Lamp next landing steps	25 0	13 0	28 3	177·4	10 30
2	Fifth lamp from Westminster Bridge	22 8	13 0	26 1½	150·2	10 35
3	Fourth do.	17 6	13 0	21 10	107·4	10 45
4	Same, with photometer to kerb	18 8	13 0	22 9	114·4	11 10
5	Next floating baths, with fluted glass lantern ..	30 6	13 0	33 3	242·0	11 20
6	Lamp on kerb under Waterloo Bridge	29 3	8 4	30 4	204·0	11 30
7	At Refuge (Brush), Blackfriars Bridge	33 7½	17 0	37 9	315·4	11 50
8	No. 9 Brush Lamp, in Bridge Street	28 8	29 2	31 5½	220·4	11 55
	.. ..	29 8				
9	Do., burning low	23 3	11 10	26 1½	150·2	12 0
10	Do., with moon in direct line	26 2	11 10	30 9	209·0	12 8
11	Corner of Ludgate Hill Station	20 0	11 10	23 3	119·4	12 15

NOTE.—The standard was two candles 3 feet from disc; height of disc from ground 3 feet.

These figures do not show any better result in illuminating power than the gas-lamps, excepting in the case of the Lontin electric lamps in Queen Victoria Street.

Electricians, such as Professor Ayrton, tell us that the power of electric-arc lights varies according to the angle at which the observations are taken, and the light at one angle is three times what it is at another. This introduces great complication into photometry.

No official figures have ever been given as to the comparative cost of the two systems of street lighting, unless we accept certain unofficial statements made in the public journals professing to give an account of the proceedings of the Commissioners of Sewers and other public bodies. But all these statements, which may have a certain commercial value, are all too vague in every sense for the author to attempt to occupy time with any comparisons founded on them. The author has given an idea of the cost of the gas lighting.

The first thing to be considered in making a fair comparison is whether the two systems to be compared possess equal advantages, and the author thinks that the electric system does not possess very many of the advantages that gas possesses. The arc system, although very powerful, is not so suited for lighting large exterior spaces as gas, because it does not possess sufficient volume in comparison with gas. What is meant by volume is shown on this diagram. [*Diagram exhibited.*] Here we have a brazier, such as is used in unloading barges and other rough works out of doors. Its light is given in great volume, whilst its intensity is very low. The rays are almost all of low velocity and slightly refrangible order, dark red, red, and orange, with a little yellow. There is a surface of radiant light equal to about 200 square inches in any direction, and its light is equal to about from 600 to 1000 or 1500 candles, according to its state of incandescence. The shadows thrown by this centre of illumination are very slightly marked. The diffusive power of the light is very great. For all these advantages it is considered for some works, such as these, superior to any other light; but for many other purposes the intensity of the light is not enough; more of the yellow and green rays are required, and consequently more of the violet and chemical rays which must follow the intensifying of the red, orange, and yellow rays. This intensity we get in gas, combined with volume, although the volume of light per 1000 candles is not so great as that of the brazier by a very great deal.

By observing the little spot of white on the right of the brazier will be seen the comparative size of the arc of a 1000-candle electric light. But this little spot is of an intensity so great that it is extremely difficult to estimate it. It is said to be more than twice as intense as the light given from a mass of iron in a fluid melting state. The diagram here shows the state of the voltaic arc and the spots which appear like melted carbon perspiring down the sides of the positive carbon. Therefore the shadows thrown by so small a point of light are intensely black and excessively broad, and consequently it is necessary to bring out this small point of light into volume by some means or other if we want to utilise it. This is most likely the reason why powerful electric lights, when fixed on their columns in the street, do not realise the effect in light thrown on the pavement which is calculated upon. For interior more than for exterior lighting the composition of the light which is made up largely of the blue, violet, and actinic rays is not so suitable as gas, because of its irritating effect on the organs of vision.

But this subject is so large that the author cannot in the limits of one paper give more than a rough and unfinished statement of the case as it regards gas and electricity, but would state in conclusion that although he feels that the advantages of gas as a means of artificial illumination are much too great for him to suppose for one moment that it can be superseded by the electric system at any time, yet he also feels that science has given another means of illumination which will find a use where it is not convenient to use gas, and where the disadvantage of want of volume and others which militate against its use for such work—for example, as lighting large open spaces where gas can be obtained—will not be of importance.

Dr. Siemens has told us that he uses it in his drawing and dining and other principal rooms as an incandescent light. Mr. Crookes says also the same thing; and in neither of these places was gas before used, and these gentlemen express themselves satisfied with it, and both of them use more gas than before. But the author hopes he may not be considered to have said an ill-natured thing if he says that the incandescent lamp inside a public street lantern does not appear to be an improvement on the gas-burner, and that in the charge of one of our lamplighters, whose fingers are all thumbs, it will not have a very successful time of it, at least in winter.

ANNUAL MEETING IN LONDON,

June 29, 30, and July 1, 1882.



ILLUMINATION BY ELECTRICITY

BY MUNICIPAL AND OTHER BODIES.

By JAMES N. SHOOLBRED, B.A., MEM. INST. C.E.

SOC. TEL. ENGINEERS, &c.,

Consulting Electrical Engineer to the Corporation of Norwich.

At the preceding meeting of the Association of Municipal Engineers in London, in 1879, the author had the honour of reading a paper on the above-named subject; as also on the bearing upon it of the Report (then just issued) of the Select Committee of the House of Commons upon Lighting by Electricity.

It appears, therefore, not out of place at this, the succeeding meeting in London, to make a few remarks on the Public Lighting by Electricity which has taken place in the interval; and also to refer to the Electric Lighting Bill now in Parliament, introduced by the Government, under the direction of the Board of Trade.

This Bill is but the complement of the Report of the Select Committee of three years ago; since, as therein advised and foreshadowed, it seeks to remove the legal difficulties which have so far trammelled the distribution of electricity; and, at the same time, assigns to it a status on a par with that of other illuminants. The probable future effects of this Bill, if it becomes law, will be of such importance to municipal authorities, as well as to private individuals, that, to glance briefly over its chief provisions, needs no apology with the members of this Association.

Furthermore, it will not be out of place to add some "Rules, &c.," recommended by the Society of Telegraph Engineers and of Electricians, for the prevention of fire, risks, and dangers to life, in connection with electric lighting.

These rules were carefully drawn up by a Committee of the Society, specially appointed, and in accord with the Fire Offices Committee of the Insurance Companies. They may serve as a sort of technical basis, whereon to build some of the safeguards contemplated in the Act.

PUBLIC ILLUMINATION BY ELECTRICITY DURING THE LAST THREE YEARS.

Among the most noticeable examples have been the following:—

TOWNS.

Date of Lighting.	Cost to Municipal Authority.	Length of street lit.	Annual cost per mile of street.	No. of Lamps.	Illuminating power of each (on horizontal).	Remarks.
CITY OF LONDON.						
<i>District No. 1. (Ludgate Hill, &c.).—"Brush" Electric Light Co.</i>						
Mar. 31, 1881 to Mar. 30, 1882	£ 660*	yards lineal 1750	£ 660	32 arc	candles. 950	1 40-light Brush machine. * Add £750 to cost, for fixing and final removal of apparatus.
<i>District No. 2 (King William Street, &c.).—Siemens Bros. & Co., Ltd.</i>						
Mar. 31, 1881 to Mar. 30, 1882	2270†	1960	2026	6 arc 23 arc	4000 330	6 continuous current machines. 2 alternating ditto. † Add £1450 to cost, for fixing and removal of apparatus.
<i>Metropolitan Board of Works (Thames Embankment).—"Jablochkoff" Co.</i>						
Dec. 13, 1878 to June 30, 1881	2½d. per light per hour	2540	1131	60 candles	380	3 Gramme double-machine ("A" and divider). 1 Ransome's steam engine, 20 HP nominal.
July 1, 1881 to June 30, 1884	1½d. per light per hour	..	753		"	
CITY OF NORWICH (Prince of Wales' Road, &c.).—R. E. Crompton & Co.						
Aug. 15, 1881 to Jan. 31, 1883	710	1700	531	5 arc 9 arc	2000 600	4 Bürgin machines. 1 Ransome's steam engine, 20 HP nominal.

TOWNS.—*continued.*

Date of Lighting.	Cost. to Municipal Authority.	Length of street lit.	Annual cost per mile of street.	No. of Lamps.	Illuminating power of each (on horizontal).	Remarks.
CHESTERFIELD (Market Place, &c.).—Brush (Hammond) Electric Light Co.						
Nov. 1, 1881. to Oct. 31, 1882	£ 855	yards lineal 3500	£ ..	22 arc 100 incan- descent.	candles 950 16	2 40-Light "Brush" machines. 2 Fowler's semi-portable compound engines, 20 HP nominal.
GODALMING (Main Street, &c.).—Siemens Bros. & Co., Ltd.						
1881 to 1882	..	1750	..	6 arc 38 incan- descent.	330 16	Alternating-current machines.

PUBLIC BUILDINGS.

Date of Lighting.	Working Cost.	Total area illuminated.	No. of Lamps.	Candles.	Remarks.
BRITISH MUSEUM READING ROOM (Circular, 150 feet in diameter). Siemens Bros. & Co., Ltd.					
Oct. 28, 1879 to Feb. 28, 1880 360 hours.	£ s. d. 108 1 4 or 6s. per hour	s. yds. 1964	4 arc 8 arc	each 4000 330	4 continuous current, 1 alternating machine. 1 12-HP portable engine. Lights in reading room distributed, 30 feet above ground.
PICTON READING ROOM, LIVERPOOL (Circular, 100 feet in diameter). British Electric Light Co.					
Oct. 12, 1880 to present time.	2s. (about) per hour, including interest and depreciation.	870	3 arc	3000	3 "A" Gramme machines, 1 15-HP Marshall's portable engine. Lights grouped centrally, 15 feet above ground.
SOUTH KENSINGTON MUSEUM ("Lord President's Court," 138 feet × 114 feet). "Brush" Electric Light Co.					
June 22 to Dec. 31, 1880 (Continues to present time.)	£ s. d. 69 2 0 or 3s. 10d. per hour. First outlay £1204.	1750	16 arc	900	1 Ransome's semi-portable 14 HP. 1 16-light Brush machine.

RAILWAY STATIONS, ETC.

Dimensions of Station.	Area illuminated per Lamp.	No. of Lamps.	Candles.	Remarks.
CHARING CROSS, LONDON, S.E.R.—“Brush” Electric Light Co.				
490 feet long } 164 feet wide } Lamps feet above platform.	a. yds. 700	16 arc	each, 900	1 16-light Brush machine, worked at Co.’s works, in Vine Street. 14 lamps in station, 2 in front.
LIVERPOOL STREET, G.E.R., AND PADDINGTON, G.W.R.—“Brush” Electric Light Co. Similar to preceding, but 2 electric machines, 32 lights, and 1 portable engine in each case.				
KING’S CROSS, LONDON, G.N.R.—R. E. Crompton & Co.				
Two spans of (each)— 800 feet long } 105 feet wide } Lamps 30 feet from ground.	2000	14 arc	2000	1 15-HP “Compound” engine, Marshall’s. 5 Bürgin “B” machines. 12 lights in station, 2 in front.
CANNON STREET, LONDON, S.E.R.—British Electric Light Co.				
680 feet long } 187 feet wide } Lamps 30 feet above ground.	1700	10 arc	2000	1 Portable Marshall’s 15 HP. 2 “D” Gramme machines. 8 “Brockie” lamps in station, 2 in front.
ST. ENOCH’S, GLASGOW, G. & S.W.R.—British Electric Light Co.				
525 feet long } 203 feet wide } Lamps 35 feet above ground.	2000	6 arc	3000	6 “A” Gramme machines. 6 “Crompton” lamps in station. Hotel engine used.
ROYAL ALBERT DOCK, LONDON.—Siemens Bros. & Co., Ltd.				
8 miles of quay, &c., en- trance dock 12 acres, sheds, hotel-restaurant.	Prime cost. £12,600	29 arc 87 arc 127 incan- descent.	4000 300 16	4 complete stations: each con- sisting of 1 20-HP engine, continuous and alternating electric machines.

The preceding tables afford a few examples of what has been done in public lighting during the last few years. In each case, however, a complete generating establishment, with its consequently high rate of production, had to be specially erected. To provide such special producing stations with gas would, it is admitted, have

been more costly in each case, both as to first outlay and as to working expenses.

If the advantages and facilities proposed by the Electric Lighting Act (described further on) are fully made use of, so as to provide large generating centres, where the electric current can be produced in a wholesale manner, with its consequent reduction in cost, the price of electric lighting will be very considerably diminished. The more so, that public lighting (which with gas is, by itself, barely, if at all, remunerative) will be further lowered in cost by the aid of the large field of domestic lighting, which electricity, by means of the incandescent vacuum lamp, can now successfully grapple with.

“THE ELECTRIC LIGHTING ACT—1882.

“To facilitate and regulate the supply of Electricity for Lighting and other purposes in Great Britain and Ireland.”

The following is the Abstract of the chief provisions of this Bill ; as amended, by the Select Committee of the House of Commons to which it was referred, and by the House of Lords.

It is proposed to obtain for the Board of Trade a general power to grant, after due inquiry

1. To the local authority of a district, or (with the consent of the local authority) to any company or person, a *Licence* for seven years, to enable them to supply electricity for public or private purposes, of illumination, &c.

2. In case of the absence of consent of the local authority, or for other reasons, to grant a *Provisional Order* (subject to its ratification by Parliament) to any local authority, or to any company or person ; carrying with it similar facilities for distribution, as under the licence.

The distribution of electricity is to be made in accordance with regulations approved of by the Board of Trade.

At the termination of the term of twenty-one years, under a *Provisional Order*, as also at the expiration of each subsequent period of seven years, the local authority of the district is to have the

option of purchasing the entire of the distributing plant, premises, stock, &c., at its *then* value; and without allowance for past or future profits.

Facilities are given to distributors for laying down conductors underground or overhead, with consent of local authority.

Powers are given to local authorities to borrow on certain rates, and to meet expenses in connection with the distribution of electricity.

Protection is afforded, under certain penalties, to the property of the distributors; and to the public from the electric current.

DANGERS FROM IMPROPER USE OF THE MAGNETO-ELECTRIC CURRENT.

As much has been said of late regarding the dangers which may arise from electric lighting, it will not be out of place to describe briefly in what way and to what extent these dangers may arise, and by what means they may be avoided. The more so, that the Act just referred to gives the Board of Trade discretionary powers in the matter, in order to preserve the public from these dangers. These dangers are of two kinds—risks from fire, and risks to life. Each is distinct from the other, and arises practically from different causes.

1. *Fire risks* arise from the quantity of the electric current passing along the metal conductor being too great for it, or from local imperfections in the conductor, due to bad or imperfect workmanship. This insufficiency of the conductor, in size or "conductivity," manifests itself in a form akin to friction, by causing the conductor, or its imperfect portion, to rise in temperature, to sometimes a very considerable degree. If substances which are easily inflammable are in the vicinity, a grave danger of fire may arise. Some important and leading precautions against this danger are laid down in the subjoined Recommendations of the Society of Telegraph Engineers.

2. *Life risks* are caused from the intensity of the electric current (potential) being more than the human frame can resist without serious shock to the system. The individual temperament, or actual condition of health, causes this limit of endurance to vary

exceedingly. The last section of the "Recommendations" deals with this source of danger, and it is to be hoped successfully.

It was generally felt that, before electric lighting was allowed to be largely introduced into use, some broad leading principles as to these dangers should be laid down. Hence the Society of Telegraph Engineers, the highest technical authority on the subject, took the matter in hand, and in accord with the Fire Offices Committee of the Insurance Companies, have just, after mature consideration, issued the following document:—

SOCIETY OF TELEGRAPH ENGINEERS AND OF ELECTRICIANS.

*Rules and Regulations for the prevention of Fire Risks arising from Electric Lighting, recommended by the Council in accordance with the Report of the Committee appointed by them on May 11, 1882, to consider the subject.**

MEMBERS OF THE COMMITTEE.

PROFESSOR W. G. ADAMS, F.R.S., <i>Vice-President.</i>	PROFESSOR D. E. HUGHES, F.R.S., <i>Vice-President.</i>
SIR CHARLES T. BRIGHT.	W. H. PREECE, F.R.S., <i>Past President.</i>
T. RUSSELL CRAMPTON.	ALEXANDER SIEMENS.
R. E. CROMPTON.	C. E. SPAGNOLETTI, <i>Vice-President.</i>
W. CROOKES, F.R.S.	JAMES N. SHOOLBRED.
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EDWARD GRAVES.	LIEUT.-COL. C. E. WEBBER, R.E., <i>President.</i>
J. E. H. GORDON.	
DR. J. HOPKINSON, F.R.S.	

These rules and regulations are drawn up not only for the guidance and instruction of those who have Electric Lighting Apparatus installed on their premises, but for the reduction to a minimum of those risks of fire which are inherent to every system of artificial illumination.

The chief dangers of every new application of electricity arise mainly from ignorance and inexperience on the part of those who supply and fit up the requisite plant.

* Copies of these rules may be had at the offices of the Society of Telegraph Engineers and of Electricians, 4, The Sanctuary, Westminster. Price 4d.

The difficulties that beset the electrical engineer are chiefly internal and invisible, and they can only be effectually guarded against by "testing" or probing with electric currents. They depend chiefly on leakage, undue resistance in the conductor, and bad joints, which lead to waste of energy and the production of heat. These defects can only be detected by measuring, by means of special apparatus, the currents that are, either ordinarily or for the purpose of testing, passed through the circuit. Bare or exposed conductors should always be within visual inspection, since the accidental falling on to, or the thoughtless placing of other conducting bodies upon such conductors might lead to "short circuiting," or the sudden generation of heat, due to a powerful current of electricity in conductors too small to carry it.

It cannot be too strongly urged that amongst the chief enemies to be guarded against are the presence of moisture, and the use of "earth" as part of the circuit. Moisture leads to loss of current and to the destruction of the conductor by electrolytic corrosion; and the injudicious use of "earth" as a part of the circuit, tends to magnify every other source of difficulty and danger.

The chief element of safety is the employment of skilled and experienced electricians to supervise the work.

I. THE DYNAMO MACHINE.

1. The Dynamo Machine should be fixed in a dry place.
2. It should not be exposed to dust, or flyings.
3. It should be kept perfectly clean and its bearings well oiled.
4. The insulation of its coils and conductors should be perfect.
5. It is better, when practicable, to fix it on an insulating bed.
6. All conductors in the Dynamo Room should be firmly supported, well insulated, conveniently arranged for inspection, and marked or numbered.

II. THE WIRES.

7. Every switch or commutator used for turning the current on or off should be constructed so that when it is moved and left to itself it cannot permit of a permanent arc or of heating, and its stand should be made of slate, stoneware, or some other incombustible substance.

8. There should be in connection with the main circuit a safety fuse constructed of easily fusible metal which would be melted if the current attain any undue magnitude, and would thus cause the circuit to be broken.

9. Every part of the circuit should be so determined, that the gauge of wire to be used is properly proportioned to the currents it will

have to carry, and changes of circuit, from a larger to a smaller conductor, should be sufficiently protected with suitable safety fuses, so that no portion of the conductor should ever be allowed to attain a temperature exceeding 150° F.

N.B.—These fuses are of the very essence of safety. They should always be enclosed in incombustible cases. Even if wires become perceptibly warmed by the ordinary current, it is a proof that they are too small for the work they have to do, and that they ought to be replaced by larger wires.

10. Under ordinary circumstances complete metallic circuits should be used, and the employment of gas or water pipes should in no case be allowed.

11. Where bare wire out of doors rests on insulating supports it should be coated with insulating material, such as india-rubber tape or tube, for at least two feet on each side of the support.

12. Bare wires passing over the tops of houses should never be less than seven feet clear of any part of the roof, and they should invariably be high enough, when crossing thoroughfares, to allow fire-escapes to pass under them.

13. It is most essential that the joints should be electrically and mechanically perfect. One of the best joints is that shown in the annexed sketch. The joint is whipped around with small wire and the whole mechanically united by solder.



14. The position of wires when underground should be carefully indicated, and they should be laid down so as to be easily inspected and repaired.

15. All wires used for indoor purposes should be efficiently insulated.

16. When these wires pass through roofs, floors, walls, or partitions, or where they cross or are liable to touch metallic masses like iron girders or pipes, they should be thoroughly protected from abrasion with each other or with the metallic masses by suitable additional covering, and where they are liable to abrasion from any cause or to the depredations of rats or mice they should be efficiently encased in some hard material.

17. Where wires are put out of sight, as beneath flooring, they

should be thoroughly protected from mechanical injury, and their position should be indicated.

N.B.—The value of frequently testing the wires cannot be too strongly urged. It is an operation, skill in which is easily acquired and applied. The escape of electricity cannot be detected by the sense of smell as can gas, but it can be detected by apparatus far more certain and delicate. Leakage not only means waste, but in the presence of moisture it means destruction of the conductor and its insulating covering, by electric action.

III. LAMPS.

18. Arc lamps should always be guarded by proper lanterns to prevent danger from falling incandescent pieces of carbon, and from ascending sparks. Their globes should be protected with wire netting.

19. The lanterns and all parts which are to be handled should be insulated from the circuit.

IV. DANGER TO PERSON.

20. To secure persons from danger inside buildings, it is essential so to arrange the conductors and fittings that no one can be exposed to the shocks of alternating currents exceeding 60 volts, and that there should never be a difference of potential of more than 200 volts between any two points in the same room.

21. If the difference of potential within any house exceeds 200 volts, whether the source of electricity be external or internal, the house should be provided outside with a "switch" so arranged that the supply of electricity can be at once cut off.

By order of the Council,

F. H. WEBB, *Secretary*.

OFFICES OF THE SOCIETY,
THE SANCTUARY, WESTMINSTER,
June 21, 1882.

To understand better some of the references made in the foregoing Recommendations, it may be as well to say a few words on the subject of electro-magnetic units.

The principal matters concerning an electric current, which it is found most important to ascertain accurately, are: the resistance it meets with, the power or energy it possesses to overcome that

resistance, the quantity of it which passes, and the intensity or rate of its progress.

The word "potential" is used to denote the electrical power or energy, which positive electricity at any given point possesses, in tending to gain the earth's adjacent surface (which surface is, in practice, considered as the "zero point"). "Potential" is, therefore, a "head" of electrical gravity, and which is due to a certain amount of work which has been expended in obtaining it. The "electro-motive force" of a conductor, or of a portion of it, is the difference of "potential" between the extremities as selected.

A Committee of the British Association for the Advancement of Science, nearly twenty years ago, investigated the question of electrical and other units. They took as the general basis for physical units what is termed the "G.C.S." system (Gramme-Centimetre-Second). The "practical" electrical units now in use (as originally recommended by them, and with some slight alterations and additions made at the International Congress of Electricians, in Paris, in 1881) are the following:—

Resistance "Ohm"	=	The resistance offered by a column of pure mercury, having 1 millimetre of cross section, and in length very nearly 40 inches.
Energy, or Potential } "Volt"		The energy of 1 Daniell cell, practically.
Quantity { "Coulomb" (formerly "Weber.")		A current having 1 Volt of energy forced through 1 Ohm of resistance.
Current, or Intensity { "Ampère" (formerly "Weber.")		A current passing at the rate of 1 Coulomb per second.
Capacity .. "Farad"		A condenser, the contents of which would be raised to a potential of 1 Volt by a charge of 1 Coulomb.

These distinguishing units are severally named after eminent electricians.

A word or two as to the distinguishing points between the two forms of electric lighting may not be uninteresting.

The two kinds of electric lights, "arc" and "incandescent" lights, require from their very nature each a current of different quality. Likewise, owing to the arrangements adopted with each kind, do the successive additions in the number of lamps produce results of an exactly opposite character in each case; each addition only rendering more manifest the respective differences in the character of the currents of each class.

"Arc" lights present each an actual gap or break in the circuit

(between the ends of the carbon rods), or path for the current from one pole of the machine to the other. This gap or jump necessitates considerable electrical pressure ("potential"), more so than if the conductor were unbroken. The successive addition of these gaps (by more lights), in the same line or conductor, naturally adds to the amount of electrical pressure or head which is required to force the current past all these obstacles, at practically the same instant of time. In practice it is found, that the exertion of passing over an arc (of ordinary dimensions) necessitates generally about 40 volts of electro-motive force; and each additional arc formed in the circuit involves, roundly speaking, the addition of that amount of electrical pressure.

Incandescent lights, on the other hand, present no gap or break in the conductor, but each affords evidence of a local contraction in the size and carrying capacity of the continuous conductor. This want of carrying capacity causes an increase in temperature corresponding to the amount of resistance; this rise in temperature beyond a certain point is made visible by a corresponding degree of luminosity.

With "arc" lights, the circuit or conductor forms one line or loop from one pole of the electric machine to the other, with the "arcs" placed in a single file or "series" upon it, each successive "arc" adding to the resistance offered to the current. With "incandescent" lights, however, the circuit is divided into two halves of equal length, and one attached to one pole of the machine and the other to the other pole, and the two kept quite unconnected from each other. The incandescent lamps are placed between each of these parallel main wires, and form the sole means of passage for the current between the two halves of the circuit, each lamp forming a bridge for the purpose. The successive addition of these lamps, by providing more passages between the main conductors, adds to the capacity of the aggregate of the intermediate of the conductor; and therefore, in proportion, diminishes the resistance offered to the electric current in its passage from one pole of the machine round the circuit to the other.

Thus while with "arc" lights in "series" each addition to their number demands a higher pressure (or potential) with the current, with "incandescent" lights in "parallel circuit" each lamp enables a lesser pressure or potential to be used. Consequently to work with advantage a number of arc lights a high potential must be

employed (as has been already seen), while to enable a number of incandescent lights a low potential must be obtained.

In conclusion, it may be said that the points briefly touched upon in the preceding remarks, illustrate a few of the progressive steps which electric lighting has made during the last three years. Considerable as that progress has been, it is not unreasonable to suppose, that during the next triennial period, magneto-electricity will have made still greater strides in application and in general utility, both as an illuminant, and as a means of transmission of mechanical power.

DISCUSSION.

The PRESIDENT: Gentlemen, you have now heard these two most interesting papers, and although some of us have given some little previous attention to the subjects referred to, I feel sure there has been a large amount of information perfectly new. It seems to me that the one great object we have this morning is just to get as much information as we possibly can; I am afraid we cannot give much as a return for that which Mr. Sugg and Mr. Shoolbred have so kindly given us. At the same time they have placed themselves at our disposal and I hope we shall do our best to gather from them still more during the discussion, and I am quite sure either of these gentlemen would be most happy to reply to any questions bearing upon the matter in hand.

Mr. PARRY: Mr. President, I do not want to say more than a word or two, as I cannot stay. I should very much like to have listened to the discussion. Mr. Sugg has referred, as an illustration of successful gas lighting, to the Reading Town Hall, and I am very glad he has named it, as he can describe its details very much better than I could, but I should like to say how generally satisfactory the whole lighting of the Town Hall has proved. I was present at the concert that Mr. Sugg speaks of. I sat in the middle of the hall, and, although the place was full, there was no uncomfortable heat, the lights being outside the hall, shining through the glazed cove in the roof. The gas lighting is not the sole ventilating power, Mr. Boyle's system of ventilation being carried out throughout the building.

Mr. BOULNOIS: Mr. President, I have listened with extreme attention to the two valuable papers we have heard, and with

reference to Mr. Sugg's paper there are one or two questions that I want to ask. I see quite early in the paper he speaks of "iron or metal"—the burners being made of iron or metal; I wanted some explanation as to what that meant. In these tables—valuable tables—as to the illuminating power of gas and the illuminating power of the electric lamps, as tested by the photometer, I should have liked very much if Mr. Sugg could have given a description of the burner, both as to the gas and the electric lamp. Then, sir, one other point that I should wish some information upon is regarding the incandescent lamp. Mr. Shoolbred explained in the most lucid manner the difference between the electric power jumping over the arc lights and passing as it were over a bridge for the incandescent. But I did not quite hear whether, supposing you had a dozen incandescent lights on the same circuit, if eleven of them were turned off, whether the twelfth would pass the whole of that power, and whether the light would be proportionally greater.

Mr. ESCOTT: In lighting billiard rooms, would the shaft be carried through the ceiling as a ventilator, or simply 18 inches above the lamp, and would it take more than one lamp to light it properly? It is a very difficult thing to light a billiard table properly.

Mr. LEMON: Mr. President, I should not have risen only some of our Members seem rather modest, so I am willing to rush into the breach. I think we are very much indebted to Mr. Sugg for the very able paper he has given us, and I think I may say that we are also indebted to the electricians for the great advances which gas lighting has made. And I think I may say that no man is more brilliant in his ideas than Mr. Sugg—he is as brilliant as his own lamps. I speak of the advances which Mr. Sugg has made, and the enormous improvements he has made, in the consumption of gas. When you look back a short time it is really marvellous; and, without wishing to depreciate in any way the labours of Mr. Sugg, it is competition, it is "*gas versus electric light*," which has brought this about. I think I may say that the electricians have put Mr. Sugg on his mettle, and the result has been a great advantage to the public, because the public evidently are led to expect a very much better light than they did before. When they have seen the lighting by electricity they have not been satisfied with the lights they used to have by gas, and they have, I think, been disposed to make an advance. And of course that advance means to a certain extent—and to a great extent, I may say—more

money, more expenditure, and they are willing to incur that expenditure because their ideas have been advanced as to the degree of lighting. I have always found a difficulty with my Corporation—of Southampton—as to the amount of expenditure. A few years ago, I may say, the tendency of the Corporation—and I fell into the same error—was rather reducing the cost and introducing every possible improvement so as to lessen the consumption, and thereby keep down the cost. Mr. Sugg has alluded to the governors placed on lamps; that is one of the first things we adopted. Then we introduced the meters, which we had from Mr. Sugg, and I may say that the result has been exceedingly good, because we made a very large decrease in our expenditure by so doing; in fact, the meters paid their cost the first year. Well, that is what we used to do a few years ago. Now we take a different line altogether, and I am very glad to say we do it. Most local bodies now want better lighting, and they are very willing to pay for it. They now put the large lamps, which we see in London and other towns, at the different refuges; and the advantages which accrue to the public are, I think, appreciated by everyone. And I fancy, I may say, that this is due to the competition of the electric light. Now, I should like to ask Mr. Shoolbred one or two questions, and first how far the generator of the electricity can be placed from the lamp—from the lighting? That is to say, supposing that a local authority had a pumping station, and had surplus power, and wanted to light their town some distance off, how far that power could be placed from the lamp which they wished to light? I have noticed in this—I suppose I may call it a Bill—that is now before Parliament, that very great powers are given to local authorities which were never thought of before. That is to say, it gives the local authority power to enter into competition with the gas companies. I do not know of any case where any local authority has obtained an Act to work gas-works where there is a gas company in existence. Of course I know, and we all know, that corporations have obtained power to buy up gas companies and get the manufacture and distribution of gas in their own hands. But I do not know of any case in which the Legislature has given a corporation powers to work gas-works in competition with a gas company. But by this Bill now before Parliament it is clear that that will be given to local authorities, for I find here that “it is proposed to obtain for the Board of Trade a general power to grant, after due inquiry,”

and so on down to "without allowance for past or future profits." It is clear that the effect of that will be that you will have an electric company—or persons lighting the streets by electricity—setting up in opposition to the gas company, who have the monopoly of the lighting. I do not know—I would not like to ask Mr. Sugg—how that is likely to work; but it is fully clear that there would be a very considerable competition resulting from it. And I am very glad to see—speaking in the interests of the public, for whom I am more directly interested—that the effect will be that we shall get a very much better light than ever before at perhaps a considerably reduced cost. Shall I be in order, sir, before I sit down, in moving a vote of thanks? I will leave it to Mr. Angell, as we were indebted to him for inviting Mr. Sugg here.

MR. ANGELL: Mr. President and Gentlemen, I must say I think we have never listened to a more interesting paper on the gas question than the one read by Mr. Sugg. I think I can claim to be as free as any man from prejudice, especially in scientific progress, and, on the other hand, my experience of gas companies has not prejudiced me in their favour. But I am free to say, on the general question, my mind is very strongly in favour of the great advantages of gas over electricity as a public light. I am not going into the matter scientifically, but taking it as a matter of fact, certainly I must confess that gas is a very superior form of lighting for public streets. If we take outside, in Parliament Street, Trafalgar Square, or taking the streets of Birmingham around the Town Hall, how much more pleasant it is than the dazing, weird effect of the electric light, with its deep shadows. There is something irritating in the electric light, and the effect, if it were universally applied, must be, I believe, to have some disastrous effect upon the nerves. The same in interiors; it is an uncomfortable light so far as my experience goes. I have seen the Albert Hall lighted with the electric light, and the Mansion House; and recently I was at the Guildhall Municipal Hall, which was lit by gas. Certainly there was no comparison in the effect. There are exceptions undoubtedly. I do not say there is no mission for the electric light; I have seen it used with very great advantage in the docks; for instance, the Royal Albert Docks, where it is kept burning all night for the lading of ships; and in lighthouses—I can understand that it has its mission there, although Mr. Sugg has pointed out that he can get the same advantages at less cost—

with docks and railways at all events. The great point is the cost, for municipal engineers. With regard to the cost we know nothing; we know what we pay, but no one can ascertain what it costs. Hitherto the electric light has been supplied as a stock-jobbing concern. Stock-jobbers have been exhibiting it; but the actual cost, if it were turned over to the municipal bodies, we do not know. I recently advertised for the lighting of two districts in the extreme east of London, but did not get a tender. I take it the extreme east of London is not a show place, and therefore it was not worth while for these companies to light it, in order to sell their shares. In the district I represent we pay some 7000*l.* a year for gas for public lamps, and we are reasonably lighted. Could we get the same effect for our fifty miles or so of roads by the electric light? and as to the nooks and corners, would they be lit up by the electric light? Electricity is so unreliable. There is danger of the lights of a whole district going out at once, and so far as I have been able to learn at present, they are obliged to keep the gas in reserve. And with regard to the very formidable list of rules submitted to us to-day, for the safety of buildings; it is found necessary to have a long series of rules drawn up, because there is great danger, not only of fire, but also to human life by accidental matters, which certainly do not pertain to gas. These remarks are rather, perhaps, touching upon the general scientific question; but, as a matter of observation, I prefer gas employed in the way that Mr. Sugg has shown it can be; and I agree with Mr. Lemon, that the great advantage of the development of electricity has been to put the gas companies on their mettle, to show what can be done. I rose, however, principally to move a vote of thanks to Mr. Sugg for giving us his excellent paper, and to Mr. Shoolbred for taking the other side of the question.

Mr. LOBLEY: I should like to ask Mr. Sugg a question with regard to the Clamond burner. He spoke of it as an incandescent magnesia burner. Most of us are acquainted with magnesium wire, which is very quickly consumed. Perhaps also he will state how long this lasts compared with the platinum burner. He also alludes to the effect of the electric light, particularly on the visual organs. I am very pleased he hopes to be able to compare favourably with the electric light even in that respect. It has been said that the objection to gas is in a very great measure due to the heat, and I think those who have seen the incandescent electric

light must be convinced that although there may be a certain amount of heat, it is really very small and not of a character to affect the eyesight. I was very much struck with this at my first visit to the Electric Light Exhibition at the Crystal Palace, because it so happened that I had rather a severe attack of inflammation of the eyes when I went. Next day I was much surprised, for I found that, instead of being worse, I was very much better. I therefore feel convinced that the incandescent electric light is not so injurious to the eyesight as the ordinary gas-burners. Mr. Lemon spoke about powers to buy gas companies. I should like to know of any place that had obtained powers to buy up a gas company—compulsory powers. I am not aware of one. Gas companies have been acquired by arrangement and agreement. I think the nearest approach to compulsory powers was in the case of Rotherham, where the company were seeking for further powers. In that case the Corporation were enabled to oppose them, and came to terms with the company; but I am not aware of any case in which absolutely compulsory powers have been given. My town tried. We promoted a Bill in Parliament one session to buy up the gas company compulsorily, and we were told there was no precedent for such a course, and it was lost. Two years after that we opposed the company, which was seeking further powers, and we again lost, though we offered them more than their statutory dividends. It is sometimes thought that the electric light is the greatest competitor with gas; but I am inclined to think that there is a much more dangerous one in the field than even the electric light, though it is very seldom alluded to. You may light the streets or open squares with the electric light, but the cottages and residences of the working classes would not be lighted by the incandescent or arc lights. Now, at the present time, the gas company will perhaps have in a long street only two or three consumers, and the others consume paraffin or petroleum. That is a far more serious competitor to gas in my town than the electric light is or can be. There is no doubt that the competition has enabled local authorities to increase their requirements in gas lighting. I am quite sure it is owing to the advances made by electricity that we are enabled now to put up some large gas lamps. They would never have incurred the expenditure but for that, I am sure.

Mr. SPICE: No doubt if we wanted simply a very powerful light, we should turn to the electric lighting authorities. I am

not here, nor do I go anywhere as a party man on this question. I think the interests of the British public are concerned more than those of the gas advocate or the electrician. My wish, my earnest desire, is, strange as it may seem, that electricity should flourish as a means of artificial lighting; and that is as much a selfish wish as anything else; for I believe that the interests of the proprietors in gas undertakings will be promoted rapidly, just in proportion as the electric light may advance in the public estimation. And this is my reason: I see that, in the past, as has been illustrated well by a gentleman here, public authorities have been satisfied with little glimmering bits of gas-lamps, which give just light enough to enable a thief to hide himself behind the post. That may seem exaggeration; but it is not an uncommon idea that, if a vagabond wants to hide, the best place is a gas-lamp. The time has gone by when that state of things would be endured. It has endured for a great many years owing to the penurious ideas of those who have to spend the money of the ratepayers. The local authorities did not put to use the money of those they represented, and there is a growl if the expenses are not kept down, and a seeking of notoriety on the part of those who desire to be members of parish parliaments to show how economical they are, and a thousand pounds is cut down to eight hundred, and a 5-foot burner to 4-feet. In the district of West Ham, which Mr. Angell so brightly adorns as a scientific man, there is a manager who came to me thirty years ago with some statements showing how unwise the parishes were in having 3-foot burners. He illustrated it by bits of cardboard, and with one of Mr. Sugg's photometers he showed that they paid 40 per cent. more for their light with a 3-foot burner than with a 5-foot burner—that they would have saved 40 per cent., in fact, by paying a little more—and that the streets, instead of being dark, and dull, and dismal, would have been well lighted. We have got—thanks to the electricians—the public woke up to the necessity for better lighting in the public streets. I am willing to believe, and do believe, notwithstanding all that Mr. Sugg has done, which we must all admire, that the electric light will prevail in large places. And I will suppose that the City of London goes on with electric lighting as it has done; although it is too much to suppose, because I find that the turn of the tide is coming; they shrink from a fresh contract with the lighting companies. But let the electric light be employed in the City, as it has been, and may be—

the effect will be that the more light we have, the more must the bye-streets be lighted by larger gas-burners, and in proportion with that, so will men who go home from bright lights in the City require more light in their houses generally than they have been in the habit of putting up with; and in that way electric lighting will be of great benefit to gas lighting. What is wanted is a state of good feeling between the two parties. I have a little book here which I have just received from America, and I will give you a specimen of the want of good taste on the part of the greatest exponent of electric lighting on the other side of the Atlantic—the bad taste, indeed, in which he speaks of us poor gas men. Mr. Edison says, and I quote from his own work: “Gas is a barbarous and wasteful light. The distribution of gas through a city is done by an immense system of sewerage pipes”—why should he give you the idea of sewerage? I should have thought he would have said a pipe—“through which it is forced and kept under pressure”—who would growl more than the British public if it were not kept under pressure?—“kept under pressure. The gas reeking with impure material and made by a dozen different processes is allowed to escape through holes into our parlours, where it is burnt, taking oxygen from the air to support combustion, the products of which are carbonic acid gas, carbonic oxide, sulphuric acid, and sulphuretted hydrogen, and a host of other substances which vitiate the atmosphere.”

I do not know what the obligations of American gas men are; but Mr. Edison may be told that we are taken care of here by a Parliament, moderate and imperfect as it is, superior to that which meets at Washington, and we are not allowed to send carbonic acid gas, or sulphuric acid, nor any other of the “host of substances” which the American people have to put up with.

“The result is a vile poison,” — that is not an endearing term,—“the result is almost entirely heat, and only”—would you believe it, sir?—“only incidentally light”—only incidentally a little light! “It is a yellow light, too, and far removed from the colour of natural light, and is charged for by quantity, and not by quality, for it is passed through meters that measure the quantity and not the quality of the light—certainly a wrong system. At the source of supply the crude material, the coal, is passed through a distillation process, through which it is liberated from other constituents of the coal more or less imperfectly”—*we*

are in the habit of thinking we do it perfectly—"it is then stored in a gasometer ready for distribution."

Well, sir, I will not read any more. We are met by the high priest of electricity in this bad form. Now, I say to the electricians, "Gentlemen, go on and prosper; we, as gas men, shall be pleased with your success." We will do what we can to maintain the position we have attained to, and I believe, sir, we shall be successful, and shall keep the position we have long had; and that the public of the United Kingdom will soon find that there has been too much talk and too little light—*too much obscurity with regard to the cost*, which will all be known by-and-bye; and when the truth is revealed it will be found that we gas men have nothing to complain of, but much to hope for. With regard to what has been going on in Parliament, I have had to watch that closely, and I have written a letter on the subject from my stand-point on one of the resolutions, and that is Resolution No. 8, which is incorporated in the Bill which is before Parliament, but will have little chance of passing, I believe, this session. It provides that when an area has been handed over to an electric company, within that area, hitherto lighted by a gas company, electricity and gas may compete for public favour, and that when the gas company find they have suffered to such an extent that they get nothing by lighting it, *then* they may go to the Board of Trade and prove that to be the fact, and then the Board of Trade "may"—not shall—relieve the gas company of its obligation to maintain a constant supply within that area. Now sir, that is a hotch-potch kind of legislation which will not hold water at all. Every statutory gas company exists by reason of a special Act of Parliament, which has been obtained in the face of opposition. Everybody has the right to be heard before the Committee of either House, and every Act has been obtained on the condition that the company be saddled with certain obligations. Privilege and obligation are conferred in every Act of Parliament that is passed, the reason being that Parliament takes care of the interests of the public when dealing with anybody seeking to be incorporated by statutory authority. Now, sir, the capital of your gas company is fixed; the dividend is fixed; the quality of the gas is fixed; its purity determined, its illuminating power fixed, and the obligation rests upon them to maintain a prescribed pressure at every hour of the twenty-four—different between sunset and sunrise and sunrise and sunset. Now, sir, take this case, that the electricians mean what they say—as no doubt they do; that they are going to succeed.

They apply to the lighting authority and get their consent; and go to Mr. Chamberlain and get a licence. That will be in force for five years. In a short time they ought to have a very good business in that district. If they take one-third of the business done by the gas company away from them, that will be a serious inroad into the business of the gas company established by statutory authority, the shareholders of which have subscribed on the faith of an Act of Parliament. The original shareholders of it may be gone, and under the provisions of a recent Act, every share in that company has to be sold by public auction. With regard to this old capital and to the new capital bought at market price, it has been purchased on the faith of an Act of Parliament; because they have every right to expect that whilst the gas company fulfils its obligations, they shall enjoy their privileges. No one ever dreamt of Parliament putting an end to the title they have given them to their properties while the terms have been maintained on the part of the company. Now, sir, why is it that the Board of Trade should seek to go behind the back of every Parliamentary Committee by which special Gas Acts have been passed? Why is the Board of Trade to go behind every Act and disturb a settlement effected after close argument? Now, sir, it may be that if the electricians take a third of the gas consumption away, that they take away the entire power of the gas company to pay a dividend at all. As a rule it will be found that one-third of the gas company's receipts is required to pay a dividend. If gas is sold at 3s. a thousand feet, 2s. will be the cost, and 1s. is for the dividend. If one-third is gone the whole dividend is gone. Why should they be treated in that way by legislation? It is quite enough for us to compete as now, for everywhere the gas companies find petroleum or paraffin a serious competitor. It is quite enough to deal with natural matters which may interfere with the success of a gas company; but, for goodness' sake, do not disturb a title solemnly given by Act of Parliament interfering between two bodies willing to compete. I am willing to compete; I only say, relieve us from the obligation you imposed upon us. This was what I would have proposed if I had been put into the box. When you have given away the cream of our business—for it is natural, I think, to conclude that when an area is selected, the best area will be selected, the centre of a town—when you have taken it, and a large public building is gone, or any large building, allow me to take my meter away and my service-pipe away, and give me a month's notice

when you require me to come back. Do not leave me liable to have the gas turned on in a moment. The least you can do is to allow me to practise economy. If 2000 retorts out of 6000 are rendered useless, I should save my fires, I should lessen my staff. But if I do that I place myself on the horns of a dilemma; I have an Act of Parliament, and its obligations rest upon me to give a supply at any moment, and the supply can be turned on at any moment. If that law is not altered it would operate not only against the interests of the gas company, but against the interests of all those who choose to use the means of gas lighting. The number of retorts employed are just what are required; if it were not so you would not have gas at the present price; economy is, above all, one of the virtues of a gas company, and it is by economy, the adoption of modern means and applications of economy in every direction, that the supply of gas has been improved in quality and price, and every statutory gas company should certainly be left free to exercise it under the new conditions proposed to be imposed in favour of electricity.

Mr. SPENCER: It is with a considerable amount of hesitation that I venture to rise after having heard such excellent observations on the subjects before us by gentlemen who are evidently so thoroughly acquainted with them, not only in the abstract, but in detail and technically. It leaves very little for us who are not acquainted so scientifically with the subjects to say. All I will venture to do is to endeavour to elicit information by putting a few questions. Should I or any of us be tempted to make a few remarks otherwise, I hope those scientific gentlemen present will not be critical, but will receive these remarks in the spirit in which they are intended—that is to say, not so much to receive from them any correction or reproof, so to speak, but rather to elicit from them information, and to get them kindly to undeceive us on any point on which we may be mistaken. There is one question which has greatly struck me this morning; that is, the very meagre details we receive from both sides as to the cost. We can scarcely, perhaps, expect at the present time that very reliable figures as to the cost shall be given by the electricians; electricity has yet, in many methods and details to be developed. But we have very meagre details of the cost of gas lighting; Mr. Sugg did inform us that in certain cases seven times the illuminating power had been produced at about three times the previous cost. In the majority of cases, however, and especially in the pro-

vinces, this gives very little satisfaction, because I believe there is very little desire in those places to increase the cost threefold; I think what is more wanted is to know how much improvement can be obtained at the present cost. I hope, therefore, that Mr. Sugg, or some other gentleman, will be able to let us know what is the actual and what will be the probable cost of the improvements in gas lighting which are expected. With regard to the electric light, I think it seems now—it must have time to be generally believed—that the electric light will be very much used for the purpose of illuminating large open spaces; and if that be the case, I think we must accept the situation—that the electric light will have to be worked together with gas—that is to say that gas will never be entirely abolished as a lighting power. I do not at the present time see how the electric light, with its brilliancy and its deep shadows spread over a large space, will be suitable for lighting narrow places and back lanes, where the rays of light will be frequently interrupted by walls and other obstructions, and cause black shadows to be cast over the whole of the narrow street. Mr. Lobley, in his observations, has made a very interesting remark with regard to the competition of oil. I believe that, in towns chiefly inhabited by the working-classes, oil is used to a very great extent—in fact to a larger extent, speaking broadly, than gas. There is in the north of England a lamp used, and I could mention districts of local boards which are entirely lighted with it; and that is a kind of lamp where the oil is burned with a tap burner, similar to the gas-burner to some extent; that is to say, that the fumes given off from the oil which is held in the reservoir of the lamp are burned in a burner somewhat similar to gas. I believe that the system has given great satisfaction. With regard to the very interesting remarks from Mr. Shoolbred, I would venture to ask him, as to the arc light, whether there is not a certain kind of light something between an arc light and an incandescent vacuum light, which may, perhaps, be understood as a sort of incandescent arc light, which would be very useful for illuminating streets and buildings where the arc light would be too powerful? There is another question that I should like to draw his attention to, and that is the colour of the electric light, which you are aware—I am now of course speaking of the arc light—gives a very unpleasant greenish or bluish light; whether by an arrangement of coloured glass, either in the lamp or from the ceiling of buildings, such a light could not be produced

as would be equally pleasant and safe to the sight with any gas-light now extant? With regard to Mr. Sugg's remarks about the experiments in the House of Commons—from what he said, that the electric lamps were lowered down beneath the ceiling into the room—I would like to ask whether, if the electric light had been kept within the coloured glass there now, the electric light might not have been very much more successful? With regard to the remarks of Mr. Shoolbred as to the use of the incandescent vacuum lamp, I was rather surprised to hear that the larger size of lamps can be so much more easily made, and I am astonished that in those instances where the vacuum lamp has been utilised, that system of larger lamps has not been more generally used than the plan of grouping two or three together. In one instance I have in my mind, a certain establishment has been lighted up with the Swan lamp, and I do not see that there could possibly be any excuse for the system of grouping three lamps together, which they have done at that place, because this was a place for which the order was given a very considerable time before it was carried out. The lamps were manufactured for the purpose, and yet in each instance they have put three naked lamps together underneath a shade above the level of the eye, allowing the light to come direct on the eye of the spectator in the most unpleasant manner. These lamps are simply within a vacuum globe, and give three brilliant specks, so to speak, which fall upon the eye and cause a very unpleasant painful feeling to it. Then with regard to the motive power. I think the question was asked whether, in the case of a pumping station the surplus power could not be used in driving the electric excitors? I would like to ask Mr. Shoolbred whether it is convenient to get the electric light from an engine which is being used for any other purpose, either at the same time or during times when it is not being used; also if Mr. Shoolbred can give any information as to the heat given off by the vacuum lamps at the Savoy Theatre. With regard to the last speaker, he certainly amused us very much by his quotation from Edison's book; but while I agree with him that the language used was a little stronger than it ought to be, I think we all know that the gas supplied to us is very often indeed in a very impure state and the cause of very injurious effects. It is quite true, as he says, that we are not allowed to have all these injurious ingredients given off from the gas; but as a matter of practice we do know that some of them at least are present and given off, whatever the reports of the

public analyst may be who tests the gas at the gas-works, with the companies' own apparatus, and, generally speaking, in the manner in which the companies themselves would like to have it tested. I cordially agree with the vote of thanks which has been proposed, and I am very much obliged to these gentlemen, who have come here to-day to enlighten us upon this very interesting subject.

Mr. McKIE: Some time after the screw-steamers came into use I was very much puzzled with the term "s.s." in the newspaper notices of the sailings of vessels. I could not think for a short time what this "s.s." meant. But I should not puzzle you if I expressed the indebtedness of the meeting to the three "S's"—Messrs. Sugg, Shoolbred, and Spice—for the valuable and interesting information they have given us upon the important subject of gas *versus* electric light. They have rendered this meeting a wonderful success. I do not wish to trespass upon your time, but I cannot refrain from expressing the pleasure I have felt in hearing such an able elucidation of the subject.

Mr. EAYRS: Has it been proved that you can get the same illuminating power out of the electric light produced from a gas engine as from the gas consumed in working the engine?

The PRESIDENT: Gentlemen, the time has gone by so far that having another paper still to occupy our attention, I feel it is well for us to draw to a close. We must all agree with our friend Mr. McKie, that we have received information of the most valuable kind and given in a manner that is deeply interesting. Before asking these gentlemen to reply, I think it is quite right that I should put the proposal as emanating from Mr. Angell and so thoroughly supported by Mr. McKie, of our most sincere thanks to Mr. Sugg and Mr. Shoolbred, and our other friend, Mr. Spice (who has vanished seemingly), for their kindness in coming amongst us to-day and giving us the details, of which they are so thoroughly masters, of matters that affect us in our separate capacities in the towns we represent. I have much pleasure in moving that the thanks of this meeting be given to these gentlemen.

Carried unanimously.

Mr. SUGG: Mr. Boulnois was kind enough to ask for some description of the lamps which were tested in the streets of London. If you will allow me, I shall not give it. The reason why I do not give it, is this—there are several competitors in the streets of London, myself amongst the number, and I have given you some typical lamps of the whole—some of every one of them—and I

do not think it would be fair for me, having apparatus at my command, to go and test all these lamps. I think it would be better that I should not attempt anything in that way before an audience such as I have the honour to address; you can see yourselves the different lamps, and can probably form some idea of what they do; and there is not a very great deal of difference amongst the lot of them. With regard to the burners; the old burners used to be made of cast iron principally, and it is found that cast iron which carries the heat down to the pipes below prevents the flames from giving as much light. By using the modern steatite burners the heat is maintained in the flame and it gives a better result for every cubic foot of gas burned. With regard to the lighting of the billiard room—the question put by Mr. Escott—the chimney carries off the products of combustion out of doors. Whatever the height is, the length of the shaft does not appear to make any difference in the working of the light. Mr. Lemon, of Southampton, spoke of the competition of gas lighting and electricity. Well, there is a competition going on, and will go on. Whether it will be to the detriment of electricity I do not know, I feel tolerably certain about gas. With regard to the ideas of the public about the cost, there seems to be this—that the public have been so frequently told that electricity costs nothing, I think they have got an idea that, if they put a wire outside their window, they will be able to get a light all over the place. Of course, that is not the case; it is a question of force to be changed into light, and it is probable that the introduction of additional machinery will necessarily increase the cost. The simplest way will be to convert coal into gas and use it in that way rather than put the coal under the boiler. All the forces are convertible into light, and they are all of them as we have seen convertible the one into the other, but convertible at a cost. What that cost will be as regards the electric light there is no possibility at the present moment of knowing, because those who have had the means of doing it have generally not said anything about it. With regard to the competition mentioned by Mr. Lemon and also by Mr. Spice—about the difficulties the gas companies are placed in—I may state that in the City the Gas Light and Coke Company supply that district which is lighted by electricity, and they are not allowed to shut their lamps off, and when the electric lamps went out they were lighted up immediately. And that has been the case always; whenever the electric lights went out, the gas-lamps were lit up.

Mr. SHOOLBRED:—Not universally.

Mr. SUGG: It has been the case in the City. If the gas companies are to be compelled to lay mains to do the lighting only at the time when the electric light goes out, that will not be a very paying concern; and electricity must decide once for all whether it is going to light without the propping up of gas, and under Parliamentary restrictions the same as gas. If the light goes out they must bear the consequences, and not gas and electricity go side by side. Mr. Angell spoke of the irritating effect of the electric light on the eyes, and alluded to the colour; I did not mention the colour because there may, perhaps, be a difference of views about that. My impression is that it is not the colour of daylight. I have explained to you that most of the rays are from the violet end of the spectrum, and not from the red end of the spectrum; the consequence is that it contains more of the specially actinic rays, and rays moving with a very high velocity not suitable to our eyes. As far as anything being done in the way of interposing screens for the purpose of softening the light, that of course may be done, but it will be done at some expense. With regard to the Clamond burner and the consumption of the magnesia, one of these little baskets is considered to last about forty hours, until it becomes dissipated: it is burned away and vanishes. The consumption of the platinum is stated to be a longer operation; but from experiments I have seen tried myself, the moment you heat air and bring the air into contact with the platinum, it causes such intense heat that the platinum is melted by it.

Mr. LOBLEY: The question I asked was—was it the metal magnesium or magnesia, and which is magnesium oxide?

Mr. SUGG: Magnesia.

Mr. SUGG: I have tried a great many experiments with platinum, and that has been generally the case—it was fused. With regard to the heat rays affecting the sight, the heat rays are the least refrangible and move with the lowest velocity; and it is probable that the rays which affect our sight are the more refrangible rays, and those which move with the higher velocity; it is certain that the more you approach the end of the spectrum towards the violet rays, the more irritating is that upon the eye. It would be impossible for us to stand the continual effect of the chemical rays upon the eye, although they are very good for vegetation. Of course, with regard to the effect of the light, different people have different views; some with very strong eyes would not feel any ill effect from it, whilst others with weak eyes would feel a very great

effect from it. With regard to the competition from petroleum-lamps, of course petroleum-lamps are not so cheap as gas; but of course the installation of gas in poor places is always difficult. Therefore they prefer to use lamps, and we scarcely think of their danger. Certainly every week we read of two or three explosions or fires caused by the oversetting of lamps. I think if the gas companies would give greater facilities for gas-lamps in workmen's cottages, the petroleum-lamps would very soon die out. Mr. Spencer has asked about the cost of gas. I have given the cost of gas at the Reading Town Hall, and the cost, as far as possible, in the ordinary street lighting. As far as the cost of the electric light is concerned, that I cannot give you. If we could make a comparative examination of the two lights—but the difficulty is in the estimation of the light, and also in the estimation of horse-power. For instance, I have found with that a certain dynamo-machine, one of Siemens', it took four horse-power to produce a thousand candles; but we are told constantly that one horse-power will produce a thousand candles, therefore there must have been a difference. The assumption of the photometer is that a lamp gives the same light always in every direction. Now the electricians tell us that it is not so with the electric light; that at an angle of thirty degrees it has a certain illuminating power which at another is doubled, and at another even trebled. All these things are eliminated from our gas photometry; we only know one thing, that the light is given in all directions. Of course, there must be corrections introduced; but we do not at present know what they are going to be, and therefore I can give you the exact cost of a thousand candles in gas only. With regard to the electric light for lighting open spaces, I have mentioned that in my reply to the remarks of Mr. Lemon, that where they are done together, some arrangement must be made to take away the loss that would accrue to the gas company from the lights only being used occasionally when the electric light goes out. With regard to the House of Commons' electric lighting, the lamps were lowered down. First of all they were used on the ceiling, but they could not get light enough on the floor of the House. Then they were lowered, and they did not get light enough. They were removed because the light was not so satisfactory as from the gas. Dr. Lyon Playfair said he thought that when the electric lights were in the House, there was as much light as from the gas, but it did not appear to be so satisfactory. With regard to the impurities of gas, I can say that the gas of Newcastle at all events is tested by Mr. Pattinson, who is a well-

known authority, and not in the way that the company likes best; he takes his own process to find out what are the impurities in the gas, and the gas company have nothing to say in the matter; and, with regard to this testing all over the kingdom, both for illuminating power and for impurity, by the rules and regulations of the gas referees—an independent body, of which Mr. Harcourt and Professor Tyndall are members—they laid down certain rules and regulations, and also the apparatus to be used over all the kingdom, and therefore the companies have not one word to say about the way in which gas is tested. It is tested in the most severe way that is possible, and the small amount of impurities that remain in it are not worth consideration. With regard to driving a gas-engine to produce light, there is an engine which you can all see very readily at Samuel's, the tailors, in Ludgate Hill. They are lighted by twenty lamps, and the power is 23 horse-power indicated when the lamps are all going, and in that case the cost of the gas for driving the engine is two shillings an hour. I believe that is a little in excess of the cost they previously paid for gas. It will be rather difficult to get it exactly, because they have still a large number of gas lights, and they have to add the increased cost of the light which the electric light requires—the greater amount of light in the other places. The fact is they burn more gas than before, so it does not look as if the burning of gas in an engine would give you any more light by electricity than in burners.

Mr. SHOOLBRED: In the first place will you allow me to thank you, Mr. President, and the Members of the Institute for their very cordial vote of thanks for the information contained in the paper. Mr. Boulnois asked, in the case of a number of incandescent lights—say, in an extreme case, if eleven out of twelve were to go out, would the remaining light receive the entire of the current intended for the twelve? Of course that extreme case can never happen. But one that does often happen—suppose that of two, one goes out, the whole current passes through the remaining one, and the result is double the light from that. In the extreme case he supposes, one could not bear the whole of the current without rupture; but long before that the safety fuses would act. The safety fuses are simply portions of lead wire, or tin-foil; their maximum power is about fifty per cent. in excess of any current which ordinarily passes through the conductor, and if the conductor gets to this extent it simply fuses these, ruptures the circuit, and that portion goes out; and these fuses are a very

great safeguard against any chance of overheating the wires. With regard to the question that Mr. Boulnois asked Mr. Sugg about the lamps (and Mr. Sugg did not wish invidiously to answer), some information was given by Professor A. Vernon Harcourt in a paper at the Royal Institution in May last, on the relative value of different illuminants. Mr. Lemon asked a question about the distance of the lights from the machine—if there was any limit to the distance? Practically there is no limit; it is a mere question of increasing the size of your conductor to offer less resistance to the passage of the current—the larger conductor causing less electric friction. You provide more copper for it, and by that increase you can carry it for five or six or ten miles instead of as many hundred yards. With regard to the Electric Lighting Bill, Mr. Lemon spoke about the principle upon which this new illuminant was entrusted to municipal authorities, and, as it were, seemed to consider that a hardship was imposed upon gas companies; and several other remarks have been made upon that point. I think I will defer these till later on, when I reply to some remarks of Mr. Spice. Mr. Angell was asking about the lighting of streets, and remarked about the arc light and the shadows that occurred thereby. Now, there have been several speakers who have referred to the shadows cast by the electric light, and I for one deny totally that there is any necessity for such shadows. That, and the injury to eyesight, is simply due to the barbarous method in which persons have chosen to stick up their lights, and pour down the light. If a proper arrangement of lanterns were adopted, a properly reflected, and a very safe light would be the result. An example of this had occurred at the Crystal Palace, in the Chinese Court, which was lit by two arc lights; and it was acknowledged to be a good soft light. The Duke of Edinburgh on the opening day, stated, that he considered it the pleasantest lighting in the building. With regard to the relative cost of lighting large buildings by gas or by electricity. There is a large public hall at Norwich used for meetings and concerts, and where the musical festival takes place. St. Andrew's Hall is an old large Gothic church, and difficult to arrange, especially at the time of the musical festival, because the benches and orchestra slope up very much so that the audience are on different levels, varying perhaps 20 feet from one another. The lighting by electricity is effected with only two lights, and even those at the top of the orchestra expressed themselves perfectly satisfied with the soft, subdued lighting. The cost of those two lights would be probably about sixpence an hour each;

that would be a shilling for the two. Now against that you have to put the actual cost of the gas light. It requires a good 1500 cubic feet of gas to light the place. If it had been lit by incandescent lamps, it would have come to about the same cost as the gas, or rather less. With regard to Mr. Angell's remarks about fire risks and the recommendations of the Telegraph Engineers, and implying that the risks from electricity were equal to those from gas. This I totally deny; they are very much less than with either gas or petroleum. The insurance companies, wishing to take advantage of this new line of business, have no objection to the dangers being magnified, and some of them would like to charge higher rates. With gas one is always liable to the greatest dangers from leakage, which may continue and end in a violent explosion. With regard to life risks, it was absolutely necessary that we in this country should not run the risk that they are running in America and elsewhere, from the very high tension of some currents that are in use. The last clause of the recommendations effectually deals, it is hoped, with this danger. As to the cost of the electric light. If there is a subject upon which we have in England more valuable data than another, it is the production of horse-power, and that is the essential item in the cost of the electric light. It is the principal item, and there are plenty of data on the subject, and its cost is generally well known. It is requisite only to add for certain contingencies, which vary with the wages in various parts of the country. The small experimental engines so far used are naturally very much more expensive than large fixed engines. These engines of the agricultural type require four, six, and eight pounds of coal per indicated horse-power per hour. Large types of engine, such as will be used when electricity is supplied on anything like a scale at all to compare with gas—it is well known can work at only two and one quarter pounds, even at one and three-quarter pounds, per indicated horse-power per hour; and therefore there is no difficulty whatever in ascertaining the cost. These data have been given in a number of different cases; and it has never been represented, even by the most sanguine of the companies, that the electric light would cost nothing. The very chemical constitution of gas shows that it has much greater elements of heating than of illuminating. Bunsen himself showed some time ago—and I pointed it out in a paper that I had the honour to read before this Association three years ago—that out of every hundred volumes of gas, only six and a half were fit for

illuminating and eighty-seven for heating, and the remainder is simply dissipated in various other ways. This accounts for a fact that will answer Mr. Eayrs about the motor. I presume that he wants to know whether there are any comparative results of gas as a motor and as an illuminant. There have been several cases. Some time ago, in this very Select Committee of the House of Commons—three years ago—Sir William Thomson and others gave some. Owing to this difference in the inherent units of heating and illuminating, the gas used through a motor or gas-engine produces much more effect than when used as an illuminant, and the same amount of light is produced by a gas-engine and the electric light cheaper than by the gas as the illuminant. Mr. Lobley mentioned the possible injury to sight from a large electric light, and protection from the direct rays. It is highly injudicious to use these lights so that the direct rays should fall upon the spectators. There is an enormous amount of heat given off in electricity, but it does not radiate as from gas; it is considered by physicists to be effected more by convection than by radiation. And though the temperature of an arc light is probably about 5000° F. and of an incandescent light about 800° F., that heat is not radiated to any distance. Three or four inches away it can hardly be felt. Hold a tallow candle three or four inches over an electric light, it will not be affected; but over a gas flame, it will soon be melted. With regard to the competition between paraffin and gas, the former is perhaps even a more dangerous competitor to gas than electricity. In Norwich a very large quantity of lighting that the gas company there had lost is carried out by paraffin, not merely in cottages, but very large houses and establishments; and in all cases I was informed that the paraffin illumination was very much cheaper than the gas. Mr. Spice has introduced his remarks by requesting that an amicable feeling between gas men and electricians should prevail, and that they should not be considered as hostile camps wishing to beat each other out of the field. I cordially agree with him; and I deprecate very much that wholesale boasting that has gone on in some parts. But I must refer to the tone which electricians of considerable eminence have always taken. Dr. Siemens—and I also in my humble way—has always deprecated the idea that one was trying to ruin the other. Gas will probably continue to flourish, the competition between it and electricity will certainly be useful, and the public will derive benefit from it. One point that Mr. Spice referred to was with regard to the removal of the liabilities of gas companies. I had the pleasure

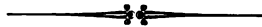
of being present in the Committee when the question was discussed, and the Committee recognised the force of the argument to some extent, and lately introduced a clause providing for the gradual removal of their liabilities as soon as there was any tangible harm, and in proportion to the harm; but that it should not be removed in any other way than gradually. But one point Mr. Spice has not mentioned which certainly ought to be taken notice of. It was, that in the early days of gas lighting there were no such liabilities attaching to it, and only when it had grown up to a mature system were they imposed. It was stated, that it was only in 1867 that these liabilities began to be introduced. It was very fairly asked that electricity should be treated in the same way in its infancy; it would be only right to impose these liabilities, and to relieve the gas companies of theirs, when an injury did occur; but till then the leniency with which gas had been treated ought to be extended to electric lighting. This argument seemed to meet with the approval of the Committee. Mr. Spencer has asked about some incandescent lights. They are the lights known as the Werdermann lights, which are incandescent in the open air, not in vacuo. The different forms of light require a very much larger amount of mechanical energy in proportion to the light they give, and these semi-incandescent lights require a very large proportion. It is generally acknowledged by electricians that they are hardly economical enough for general use. Another question, I think you mentioned an arrangement of incandescent lamps where they preferred to use triple lights instead of one giving greater intensity. The Swan Company have been making a certain type of lamp, and it is as much as they can do to supply the public with it, and they probably have not had the time to turn their attention to the larger lamps. That is the reason why three would be used. The larger type would require certain arrangements as to the proportion of current to pass through, that without a little trouble would not be carried out successfully. If you put one of these large burners, and only had the ordinary proportion of current through it, the result would be that you would have a dull glimmer. I think I have mentioned most of the questions, but if I may be allowed, if I am not detaining you too long, I would just mention a word or two with regard to Mr. Sugg's paper. He spoke of Professor Tyndall, and referred to the red rays, and also to the ultra-violet rays. The general impression with the public is, that there is an absence of red rays in the electric light. Now

Dr. Tyndall himself, in a discussion on lighthouse illumination by electricity,* distinctly states that the electric light is richly endowed with all the constituents of light, and, if anything, it possessed a larger quantity of red rays than other illuminants. Mr. Sugg, in his remarks on the photometric measurement of the electric, must surely be aware that they apply only to a very small portion of the large arc lights (those from continuous current machines), and to incandescent lights (by far the larger application in the future) not at all. To his table of "Illuminating power of electric lamps" I must also demur. Some of the lamps there named (the "Lontin," for instance), had been removed some time previously. Again, why not give the actual "candle-power," instead of the "size of gas-lamp calculated to produce the same result," which is certainly ambiguous. The lighting of the House of Commons, which Mr. Sugg has referred to—the lighting by the Brush Company—cannot be accepted in any way as typical at all of electric lighting. They were hampered by many circumstances, and the Brush lights were put up without the slightest aid to reflect the light, quite irrespective of whether the Brush light was the one best suited for that place. I also have had occasion to turn my attention to the illumination of the House of Commons, and I should certainly not have made use of that form of light or its treatment; and I must certainly deprecate its being considered as typical of the state of electric lighting generally. It would add much to the interest of the paper and to the list of town lighting given in it if Mr. Sugg would have added to his paper the cost of lighting Whitehall and Trafalgar Square. It would have afforded a comparison with the lighting by electricity in the City of Norwich; the length of thoroughfare and other circumstances having something in common. It would have been of interest to the Association if we could have known what was the cost of the lighting, or the consumption at all events of gas; because I think myself that the consumption of gas in these large burners, 100 and 150 or 200-candle burners, is going beyond the economic limit of competition between the two illuminants. I think electricity will supply that quantity of light at considerably less, whereas small quantities can be produced more cheaply by gas than by electricity. Personally, I have to thank Mr. Sugg for introducing these large lights; they have been the most successful promoters of electricity. Wherever the Sugg street lamp makes its appearance the electric light is sure to follow.

* See Proceedings, Inst. C.E., vol. lvii. 1879. Paper by J. N. Douglass.

ANNUAL MEETING IN LONDON,

June 29, 30, and July 1, 1882.



SANITARY LEGISLATION.

By G. B. JERRAM, Assoc. M. INST. C.E., SURVEYOR TO THE
LOCAL BOARD, WALTHAMSTOW.

It may be thought that this subject is not one which should be brought before an assembly of Engineers and Surveyors holding public appointments in various districts, but such as should be reserved only for law makers; and also that as the Members have so much to do with this matter in their daily work, that at any rate at the Annual Meeting they might more profitably turn their attention to discuss technical and practical matters connected with their profession; but the author thinks if the subject be further considered that much will be found that, although familiar, will bear consideration and discussion at their hands.

The author is well aware he is treating of a matter which has constantly been discussed at various times by this and other kindred societies, but inasmuch as we live in an age of progress and advancing knowledge, and fresh difficulties and phases of the matter arise, it may not be unprofitable at intervals to compare our various experiences, and thereby devise some results that may tend to the benefit of the community.

Of course it will be impossible in the limits of a short paper to treat the subject in a thorough and exhaustive manner, and the author proposes therefore briefly to refer to certain details, and more particularly to the following points: the object to be gained by sanitary legislation; the laws themselves; the means for putting them into execution; considering at the same time whether amendments are necessary for the better attainment of the end in view.

The object to be gained by such legislation is no doubt in short the promotion of means to be taken for maintaining a good state

of health among the community ; and it is one of the prominent marks of the spread of knowledge and science in this present century, that it has been found that many if not all of the diseases which affect mankind can be prevented by obeying certain laws of nature, and that many diseases which in former ages were deemed as plagues and incurable, are in these days found to be the result of the breaking of now well-known laws.

That which is most conducive to maintain health, speaking from the view of the sanitarian, is pure food, pure water, pure air ; and it has been found that man in his ignorance and greed of gain and selfishness has in times past promoted and sown the seeds of disease by ignoring the importance of these elements, in that he has polluted the pure water by pouring into the natural streams that refuse which mother earth requires in order to help it to produce food for its many thousands of inhabitants, and by mixing with food materials which are injurious to health, and then by erecting habitations in such a manner as to poison the air of those inhabiting them.

It is in order to check the spread of the thousand and one phases of these evils that our sanitary laws have been promulgated.

And thus in order to prevent the adulteration of food "The Food and Adulteration Act" was enacted ; and here the author would only say that it is quite time some more effectual means should be taken to protect persons from being victimised by the baneful effects of the mixture of inferior and deleterious matter with the articles of food.

In order to protect the purity of the natural streams and rivers "The Act for the Prevention of Pollution of Rivers" was passed, but which, owing to the important interests that are involved and the permissive character of the Act, has not proved to be of much service for the purpose. It is now quite time that this important matter should be taken in hand and dealt with in an effective and stringent manner, no matter what the interests may be that may thereby be affected, the importance of pure water in our streams being paramount above *all*.

Then we have last but not least "The Public Health Act" of 1875, which contains provisions in order to ensure wholesome dwellings and neighbourhoods, and is a very important and beneficial piece of legislation, the carrying out of which has very considerably improved the sanitary condition of our country.

As it is to this Act we owe our position, and which is nearly the

only Act of sanitary legislation that any real attempt has been made to enforce, the author proposes specially to consider this Act, which embodies in a concise and comprehensive form the necessary details for the accomplishment of the end desired. It is both compulsory and permissive in its character, and it is among the latter class of its provisions that amendment is really required, although certain other of its clauses, owing to the vagueness of the wording, have been the cause of much litigation and difference of opinion.

Thus, it says an urban sanitary authority *may* contract. Now, how many authorities interpret this to mean *shall* contract? and consequently the various works are no doubt executed in many cases at more expense than would be incurred if the authority were to construct the work themselves, although of course this must be determined by the circumstances of each individual case.

Amongst other clauses that require to be more defined are the following:—With regard to Clause 13, it states that all existing and future sewers within the district of a local authority, &c., shall vest in, and be under the control of, such local authorities, except sewers made by a person for his own profit, or by any company for the profit of the shareholders. Now it has been held that where an estate is laid out, streets formed, and sewers laid, that the board has no control or no right over the sewers, as the sewer comes under the exception quoted.

If the ruling quoted is right, does it not affect the general arrangements for drainage of the district, if the Board have no right over the sewer constructed so that other sewers may be connected therewith in order that a proper and effective system of drainage may be laid down suited to the physical requirements of the district?

Then in places where the duplicate system of drainage is adopted. There is no provision for compelling an owner who already has a drain properly connected with one sewer to construct another drain to take the rain water only.

The provision also that a drain taking drainage of more than two houses occupied by different persons makes it a sewer raises many doubts as to the control of the local authority, as the author presumes a sewer taking the drainage of more than two houses, even if laid across the back garden, would be considered under the control of the local authority, but this view is open to considerable doubt, and certainly requires to be more strictly defined.

Then the well-known clauses as regards the making up of private

roads and streets are anything but clear, and if the acceptance of their interpretation contained in a recent decision of the Master of the Rolls is right, very onerous and unnecessary burdens are cast on private owners, inasmuch as they are required to make up the streets in quite a different manner to that in which the streets under the control of the local authority are made, in accordance with Clause 149. As this question has also been discussed it is not necessary to say more before this meeting.

There are several other clauses which require to be more clearly defined, but the provisions of the 157th clause as to the permissive power of an urban authority to make bye-laws is important, but the option that is given causes very great inconvenience, and thereby arises the anomaly of different regulations for the construction of buildings in districts adjoining one another.

There is no doubt that the bye-laws enforced in many districts are not legal, as they were made before the Act of 1875, and it is much to be regretted that that Act did not contain any provision thereon. Evidently some uncertainty existed in the minds of the Local Government Board, as, in July 1877, they issued a selection of model forms for the guidance of sanitary authorities which, as regards those affecting new streets and buildings, are very different, and contain much more detail than hitherto had been thought advisable; and here the author cannot but help referring to a curious fact, that while the Public Health Act does not apply to the metropolis, yet it appears from the circular issued by the Local Government Board in July 1877, that although the Board have not hesitated to seek assistance from advisers whose practical experience rendered criticism of especial value, yet the help obtained has been acquired from authorities in the metropolis, as they refer especially to the authorities of the City of London for the clauses affecting the regulation of provincial inhabitants, and from the Commissioners of Police of the Metropolis for the clauses relating to hackney carriages and common lodging-houses; and with regard to the regulation of new streets and buildings from elaborate views of the Royal Institute of British Architects. Now it cannot be gainsaid that as regards sanitary regulations for new streets and buildings, the administration of sanitary laws adopted by some of our leading provincial towns are more in advance than those of the metropolis, and it is surprising that before issuing these bye-laws no suggestions were sought for from those public officers in the provinces who have had long experience of the subject, or even

from the staff of engineering inspectors of the Local Government Board. And now what is the consequence? Various municipalities and local boards are acquiring private Acts of Parliament, containing clauses which are contrary or additional to the main law of the land; so that in a short time we may expect to see the country having various laws for different places, and consequently the burdens on property much more unequal throughout the land than at present.

Surely it must be acknowledged that what is good for one is good for all; thus why should Eastbourne have different sanitary regulations to those of other seaside resorts, owing to the accident of a private Act of Parliament? And why should Bristol have different laws to those of Plymouth, or the Local Board of West Ham different laws from those of Tottenham, both being under similar conditions as to situation with regard to their contiguity to the metropolis.

That these bye-laws have been drawn up to assist sanitary authorities with the best intention is no doubt true, and up to a certain point they are of great use, but as is often the case where so much detail is given, important matters are omitted, and from the nature of the assistance before referred to in the preparation of these bye-laws we are led to understand how it is that we have such an abstruse set of bye-laws for buildings and new streets. There are actually ninety-nine clauses in fifty pages of printed matter; forty-three of which entirely refer to details in building construction, seven clauses to sufficiency of space and to secure a free circulation of air with respect to ventilation of buildings, six clauses in respect to the drainage of buildings, three clauses as to water-closets, five as to earth-closets, and eleven clauses as to privies and cesspools. Surely very unnecessary if the provision of the Public Health Act that the local sanitary authority shall cause their district to be properly drained (thereby evidently implying that all the abominations of cesspools and privies shall be abolished) is enforced.

Take the clauses as to the erection of buildings. No stipulations are made with regard to the construction of walls and buildings with any other materials than bricks, although we know some are constructed of concrete and iron. Although concrete is specified to be used for foundations, yet, while mortar is defined, there is no definition of what concrete is or how it is to be made, and it is well known what rubbish can be and is mixed together and called concrete. Then whilst there are many details as regards the strength

of brick walls, yet there is nothing provided for the strength of beams, girders, bressomers, storey-posts, &c. (This, from the number of accidents that have arisen owing to the weakness of the storey-posts in corner shops, seems quite as necessary to be provided for as the strength of walls.) Another important matter is also undefined, viz. the height of habitable rooms. In the circular before referred to this question is mentioned thus, that it has been sought to justify such a provision as being a bye-law with respect to ventilation; but it is stated so much doubt exists as to whether such a bye-law can be enforced, that it had been decided to submit a case for the opinion of the law officers of the Crown upon the numerous points which have been raised in connection therewith. The author last year, in revising the bye-laws of his district, asked the Local Government Board as to the result of the Crown law officer's opinion, and the following reply was received:—"The Board state that they have submitted the question for the opinion of the law officers, who have advised thereon to the effect that an urban sanitary authority has no general power, under the 157th section of the Public Health Act 1875, to make bye-laws regulating the height of rooms, for the purpose thereby of securing improved ventilation; although there may be cases where reasonable regulations, made with reference to the mode of ventilation, would necessitate the rooms being of a certain height." Now if this is not begging the question the author does not know what is, and shows another of the points requiring amendment, as it must be a most important detail in reference to health that the height of habitable rooms should not be allowed to be at the option of the speculative builder. But it seems that in some points bye-laws are still continuing to be confirmed by the Local Government Board which are clearly contrary to the law of the land. In one district near London a bye-law is in force which states that no house is to be built on the side of any new street until such street has been made up and sewered in accordance with the bye-laws. For that purpose no doubt such a regulation would be a very good one, but is clearly not in accordance with the Public Health Act and could not be legally enforced.

These few cases clearly show that the present state of the law is anything but satisfactory, and the author cannot but think that although it is quite necessary that laws should be defined, yet these bye-laws, if adopted, are such as can never be strictly enforced, and therefore are almost worse than no laws at all, and have a tendency

to relieve the proper parties from responsibility. Now as regards buildings, surely it would be easy to make simple rules for the safety of structures, similar to the Board of Trade regulations for the strength of bridges, not defining so much the manner of building as that such buildings in all their several parts shall be of such a minimum strength as to be not less than a proportionate part of the breaking weight of the materials used; then as regards ventilation, that all sleeping rooms shall contain not less than so many cubic feet for each inhabitant; the area of open space round or at the rear of the building to be proportional to the height of buildings; and as regards drainage, that such shall be so constructed as to effectually cut off any inlet of sewer gas, while permitting the rapid exit of all house sewage, &c.

Then a simple law could be passed making it penal for any house to be inhabited, unless it was certified by the local authority to be in a fit condition to be inhabited, and having complied with the general conditions, then and not until some such regulation is regularly enforced, shall we be able to obtain healthy sanitary dwellings. And the help of those whose business it is to advance money on buildings would be ensured and some protection be afforded to those who at present are the victims of the jerry builder. The author would propose also that a register should be kept of all buildings inspected, giving the date of such inspection and the condition of the premises at the time, and which should be open to anyone for perusal, and also that it should be permitted for anyone to have their house officially inspected at any time on payment of a small fee. If it has been found beneficial to inaugurate sanitary assurance societies for purposes of sanitary inspection, surely it would be much more satisfactory if such inspections were undertaken under the sanction of the local authority, armed as they undoubtedly are with strong legislative powers.

But it is no use making laws or regulations unless they are duly enforced, and although provisions are made for the establishment of local boards of health with proper officers, yet it may not be amiss to consider if the present condition of things is all that can be desired with regard to those who are entrusted with the duties of enforcing the laws. It is becoming a question whether the local authorities really do their duty, and it is to be deplored that more interest is not taken by men of business habits and of independent means to take their share in the responsible office of local government, and who will take the trouble and give the time to

study sanitary science. No doubt personal interest often stands in the way of sanitary laws being enforced, and the fear of the indignant ratepayer often prevents the requisite means being adopted to carry out the various measures of the Sanitary Act. It is also to be regretted that political feeling in many places frequently interferes with the best man being elected on the boards, and that the promoting of means of health of the community is not more studied than the showing of party colours. When one considers the lengths to which this spirit is carried in times of local board and municipal elections it is almost amusing, if the results were not so serious. To think that the question of the possession of Afghanistan has anything in common with Tom Smith's stopped drain, or the possession of Constantinople by Russia to do with the erection of an infectious hospital is of course absurd. But much devolves on the officers, although really they are not free agents in the matter, and have only to carry out the instructions of their board; and yet they have to bear the burden of all the grumbling if anything goes wrong, and it is to be feared that the stipulations of the Public Health Act will never be properly enforced until the officers are put in a more independent position than they now occupy. We can all testify to the difficulties we are under in carrying out our duties, and we are obliged to wink at many evasions of the Act in order to please those on whom we are dependent. Now this is not right, and as the carrying out of the Act is so much affected by the feelings and self-interest of the members of the local authorities, it would be much more satisfactory if the officers had a right of appeal to the Local Government Board, so that the position of an officer who did his duty should not be subject to the jealousies and petty pique of members whom he may have offended.

As the Local Government Board appoints auditors to examine the accounts of local boards, surely there should be some power to compel local authorities to enforce sanitary laws, and it would be as well that a sanitary report of how the Act was being complied with and of the sanitary condition of each district, should be submitted every year to the Local Government Board, so that it may be known how the laws are being enforced; and should any district not comply with the Act, the Local Government Board should be at liberty to dissolve such local board and cause another to be elected who will more efficiently comply with the law. And no authority should have the permission of the Local Government

Board to borrow any money unless they carried out the Act in its integrity.

Another anomaly is the different powers between local boards and corporations as regards the auditing of the accounts. Why it should be necessary that a local board's accounts should be audited by a Government auditor, while those of corporations are not so, is a curious question, although no doubt can exist as to the necessity for a Government audit of corporation accounts. We constantly hear of Government auditors surcharging members of boards and officers sums of money which are held to have not been paid legally in accordance with the Act, but who ever heard of any surcharging of members of a corporation? Surely one body is no more perfect than the other, and therefore the author does not wonder at corporations borrowing money for one purpose and using it for another, as the author knows in at least one town has been the case.

There are many more matters in connection with this subject that call for attention, but the author thinks he has in these few disjointed remarks shown that there is room for amendment in our sanitary laws, and also that it is important that the laws should be similar for the whole country. It would be a good thing if we had a standing counsel in connection with our Association, who should be well up in all cases appertaining to the Public Health Act, and to whom application could be made for advice when an officer so required it. It would also be a judicious proceeding if a Committee could be formed amongst ourselves to take this matter of amendment of the Public Health Act into consideration, with a view to waiting on the Home Secretary before the next session of Parliament.

DISCUSSION.

The PRESIDENT: Gentlemen, you have heard this paper; we must almost regret that we did not have the opportunity of hearing it earlier in the day, because there are points touched there which, although we have heard them before, it is well that they should come to the front. Our friend has touched upon some that many of you no doubt feel personally—the difficulties of the matters to which he has referred. The very fact of such a paper going out amongst our Members will do much to help forward the question of sanitary legislation—there is no doubt about that—indirectly,

if not directly, although we shall probably not be able to thrash the question out.

Mr. ANGELL: Mr. Jerram has gone over the old questions and spotted the old blots. I did not quite catch the point of one of the opening remarks. I think it is quite a legitimate and desirable thing that corporations should have the power to do their work in their own way. I do not approve of permissive legislation generally, but in matters of contract it frequently happens that work can be done better in one way than another. In the borough of Liverpool they are carrying out work very largely by their own staff, without contracts. If that is such a point to which Mr. Jerram refers, I think there is a wise discretion. One point raised there is a great deal of doubt about—whether sewers made on a private estate by the land-owners are under the supervision and become the property of local authorities before the roads are dedicated. These are sewers made for profit, and I take it that a land company making sewers for their own profit would legitimately come within the definition of Section 13, and that the board have no power over them to prevent people making connections with them. But we know what the result of each one making connections for himself would be. It is a work which ought to be done under the supervision or actually by the contractors of the local board. I think that view was advocated yesterday. If it is left for anyone to do, it will be done very badly indeed, and it is impossible to keep that supervision with the staff which we have. With regard to local Acts of Parliament giving boards powers of their own, of course that is practicable; but I think it will be stopped after this session. I think the West Ham Local Board will have the very last. It was discussed whether we should be able to go on, or whether it should be referred to the Committee to which all private Acts promoted by local authorities are to be referred, and it will be for them to decide whether the Bills shall be allowed. Lord Redesdale's great objection to it was that we were obtaining powers which the rest of the country did not possess, as Mr. Jerram said. In private Acts, we have remedied one or two of those points which are defects in the general 1875 Act.* For instance, the height of rooms. The Local Government Board say it is *ultra vires* to make bye-laws about the height of rooms. We

* West Ham has also procured, through Colonel Makins, M.P. for South Essex, an alteration in Standing Orders requiring that all Parliamentary plans shall be deposited with the urban sanitary authority, in addition to the parish clerk, &c.

have included that in our Act, and have power. There is an extraordinary omission in the Model Bye-laws; that is, for the hearths and trimmings round fireplaces. We have remedied that by putting it specially into our Act. I come to the matter of mortar or cement. The Model Bye-laws simply say that houses shall be built with "good mortar." That raises the whole question before the magistrate whether the mortar is "good" or not. It does not, as in the Metropolitan Building Acts, say what proportion of sand and lime shall be mixed. There ought to be some definition of what is good mortar; otherwise the thing will be always fought in the courts. They bring up people—architects and surveyors they call themselves—to swear that the mortar is good, and that the evidence of the surveyor is utter nonsense, and that the actual sample shown by him is not taken from the wall. I have seen one instance where the magistrates dismissed the case because some four or five unprincipled men were brought to swear on the other side. The magistrates said "the balance of evidence was against the surveyor." I am opposed altogether to the giving of certificates. With respect to sanitary inspection there is no power to inspect unless there is reasonable cause to suspect a nuisance. Supposing you imagine your house is not in a healthy condition, and you would like it examined, you have no power to call on the inspector to make that examination. Perhaps the Members will remember that in my paper last year at Birmingham, I dealt rather largely with the associations to which Mr. Jerram has referred—the establishment of associations which for a guinea a year will inspect your house. I think that it should be within the functions of the local authority to do so. The question of protection of officers has been discussed a great many times, and there are some little differences of opinion now cropping up amongst ourselves. The Local Government Board are not the most liberal-minded, and act rather stingily sometimes towards Poor Law officers. One has met with very extraordinary decisions; where a medical officer or some other officer has had some addition to his salary voted, the Local Government Board think it extravagant, and reduce it say from 50% to 30%. So there is a danger as well as an advantage in putting yourselves under the Local Government Board. Upon the question of protection, I think it is a thing certainly that ought to be obtained; but if they are also to regulate our salaries, there might be a disadvantage. On the

matter of accounts—I have been very much troubled indeed on this matter of accounts. The Local Government Board have assimilated the system of account-keeping to the Poor Law accounts. There is no analogy whatever between the accounts of a union, and the accounts of a local board, and the vexation, trouble, annoyance, of getting all the little petty details into the form required by the Local Government Board is something excessive in my district. Those under corporations escape this; but we do not. The system of account-keeping is most annoying, the auditor sent down knows nothing about the practical business and takes frivolous objections. It is so much trouble that I ought to have a book-keeping staff at my office to keep the accounts in the manner required by the Local Government Board. I think it is a pity that they did not consult some of the local officers instead of doing as they did, consult some north-country auditor, who had never had anything of the kind to do in his life.

Mr. LEMON: I hope, gentlemen, we shall not, in our anxiety to improve legislation, drift into what I call grandmotherly legislation. I think that is one of the evils cropping up now—a tendency to too much centralisation. Mr. Angell has referred to some of them, as regards the contract system—the permissive power to contract or not contract, given by the use of the word “may.” I think the word “may” should certainly remain in the Act, and that the local authority should have power, either to do the work themselves or contract, as they see fit. In the town I come from the Corporation think it is their duty to put things to contract, as regards the making of streets and other matters. Of course they take the precaution of receiving a protecting estimate from their surveyor. It very often happens that the estimate of the surveyor is less than the lowest tender; then they reject the tender and give the work to their surveyor to carry out. That is a great injustice to the builders. I know of cases where builders have been put to great trouble and expense; a surveyor provided the quantities at a cost of 40% or 50% and never got a penny for his trouble. But a corporation or local board should have the power, which I think they retain, of doing the work themselves or putting it to contract. Another item which I noted down was in reference to the bye-laws. I know there has been a great question whether the bye-laws passed prior to the Act of 1875 were legal or not. Now I say with reference to that, that as the Sanitary Act of 1875 repealed all previous sanitary legislation and re-enacted that portion of the

legislation which Parliament saw fit, the bye-laws passed prior to 1875 were clearly *ultra vires* and could not apply. Then I know several bye-laws which are not in conformity with the Act. I must say that the Local Government Board lately have been paying more attention to it than they used to. They used to pass almost any bye-law, and anomalies have crept in. I should not like to see too much attempted on behalf of local authorities—more than they could consistently carry out. It cuts two ways. I have had occasion to see my name figure in prospectuses or advertisements of houses to be sold “erected under the provisions of the Act so-and-so,” and therefore they must be good, meaning that, because the bye-laws are tolerably strict in a certain town, therefore the houses erected by a jerry builder must be good houses, and that they allege as a reason why they should get more money for them. If you attempt to legislate for everything connected with a building, you are imposing upon yourselves duties which you will never be able to carry out, and placing surveyors in a false position. It is going too far for us to attempt to legislate upon the strength of beams and girders; although we might fix the maximum strain per square inch to which any beam shall be exposed. I once had to inspect some houses at Shepherd’s Bush, and I thought the beams were remarkably good. I got a ladder and went up to look at them. They were two inches at the bottom and half an inch at the top. They were cut feather-edged. They looked very well down below. As regards the bye-law which I think Mr. Jerram said was not in conformity with the Act, that no house can be built unless a street be dedicated; it is very important that there should be legislation in that respect, because the general law can be evaded by persons putting up a house, and then afterwards applying to have a street made. You cannot prevent a man building a house in the middle of a field, if he complies with the bye-laws. He may say, “Oh, this is my residential estate.” By-and-by he cuts up that estate for building. You cannot go and take that house down. It must remain, and it may come in such a position that it is absolutely impossible to lay out the street effectually. I think it is necessary that a street should be laid out before houses are stuck up in all directions over the field. As regards the auditing of accounts, I am happily situated under a corporation, and have never been under a local board. I cannot agree with Mr. Jerram that that change should be made. I hope the day is far distant—speaking as a corporation

man, pure and simple—that ever the Government should interfere with our accounts. I think it is an abominable nuisance to have the Government auditor overhauling your accounts—there is nothing equal to it. We had a deputation the other day, and spent 130*l*. I think it was money very well spent, because we obtained a vast amount of information that we should not otherwise have had. It is all very well for a surveyor to hammer into his Board that they should do this, that, and the other; but you cannot make them believe it. Let a committee go to some other town, and see the improvements carried out, and they will come home and carry them out; and it is only by ocular demonstration that they can understand them. I hope the day will be far distant when Mr. Jerram's proposition as to a Government auditor will be introduced to corporations. That will seem to my friend, Mr. Angell, to be a selfish view, because West Ham is not as yet a corporation. But I think it will be very soon.

Mr. GORDON: The paper opens up a very wide field indeed, and I am sure at this late hour we have not time to do justice to it. But I have listened very attentively to the remarks which have been made, and it occurs to me that if we are to do anything useful in discussing a paper in our Association such as we have listened to, a very good plan would be to refer it to the Council of the Association, and that the Council should distribute the work of considering and discussing a paper of this kind amongst our district societies. That is to say, the district secretaries should be requested to distribute the paper amongst Members, and to invite them to discuss it at their district meetings, and to go thoroughly into the whole subject—not merely as to the Public Health Act itself, but as to the bye-laws, which might suit one district and not another. My impression is gained not merely from what I have heard here, but from the experience I have had on the Continent with regard to very similar discussions affecting the building laws of municipal authorities there; and it is a plan which I can certainly recommend, for I have taken part in discussions of the same kind with a view to the amendment of such laws. And I am very glad to see and to hope that the day is not far distant when our Government will listen to discussions and results arrived at in this Association. The architectural and engineering societies of Germany in each town are banded together and meet at some chief town annually. It is the province of the Council of that Association to discuss for two days previous to the annual meeting what are the subjects

which are most pressing and requiring the attention of the profession, and the amendment of bye-laws or the statute law always receives a large share of attention. They decide upon the subjects and distribute, after the annual meeting, to the district society of every town which possesses an architectural and engineering society the work which they consider ought to be discussed during the year, to be brought forward for full discussion when the whole of the societies meet at the next annual gathering. I can only say that in that way excellent results have been obtained. I cannot help thinking that a paper affecting the building regulations might be met in the same way, and that we should arrive at better results than by the mere abstract discussion of such a paper to-day, and then losing sight of it again. I believe every one placed in the position of adviser to a corporation or local board feels how difficult it is to carry out the laws. We also know that the bye-laws given as sample bye-laws to almost all corporations and local boards prior to 1875 were, with few exceptions, adopted as sent down from London. Many localities made additions and alterations; but you heard during yesterday and to-day that very few of these bye-laws are really to be supported by the statute law under which they have been made. And a question has arisen whether bye-laws made before 1875 are really to be supported by the Act of 1875 or not. There are so many questions arising out of the Public Health Act, 1875, and out of the various bye-laws, that I am quite sure that it will be not merely the work of one year, but probably two years—if we can accomplish it in that time—to frame for our own satisfaction something like the amendments we consider requisite throughout the whole of the Act of 1875, and taking into consideration also our own local bye-laws—the whole of the points which would necessarily be different in one district from another—and to frame anything like an Act or a set of bye-laws which would be satisfactory to all localities represented by this Association. I am in my own district somewhat differently situated. We have got a private Act by which we can certainly exercise a little more power than under the ordinary bye-laws. Lord Redesdale, as Mr. Angell has already said, is averse to private Acts, and therefore did not permit us last year to embody in our own Act bye-laws which we considered suited to the district, so that we were obliged to be satisfied with a few general clauses with which we thought we could operate more successfully than under the bye-laws, such as they would have been after passing through his hands.

I think under all the circumstances it would be well if this matter were referred to our Council with a view to have it more fully discussed at district meetings, and that the Members of the Association should be individually invited to give their own opinions of what the requirements of their own district may be, and what they consider to be the difficulties they have to contend with in exercising the powers of the Public Health Act. It has been said by Mr. Jerram, for instance, with regard to the sewers in private streets, that we have little or no power over those streets. We know very well that when sewers have been made according to the directions of the local surveyor in private streets, that it is equally important that all connections with those sewers should be also, entirely and absolutely, under his control. Otherwise when the time arrives that the streets have to be taken over, he may find that originally a well-executed sewer has been entirely spoiled by the connections made. I do not know what the difficulties of other Members may be in their districts; but at present I am insisting upon absolute control in private streets. So far I have certainly met with some difficulties, but I am overcoming them, and I believe in a little time we shall find very little difficulty indeed. But I am not sure whether, if any individual builder were to take the matter into his own hands—were to challenge us—whether we could uphold the course we are taking or not. The strength of materials is undoubtedly a most important item, but whether that could be inserted into a public Act or not is a matter worthy of the consideration of the Members of the Association and of the Legislature. If it can be done in general terms in a new Public Health Act, leaving it only to be followed by bye-laws suited to the various districts, it would undoubtedly be a most excellent thing; we have, I believe, absolutely no power at the present time. Mr. Angell has already instanced, for example, the article of mortar. Well, our bye-laws, one and all, I suppose, say "good mortar"; but who is to decide the question? You have all seen the instance which Mr. Clark has had before the magistrates. He has certainly succeeded, but he has had a great difficulty to contend with, and it does not follow that every other surveyor would succeed. It ought to be more clearly stated than in the Public Health Act itself, or we ought to have the power under that Act to set forth, when it says mortar or concrete, how it should be constituted for a particular district, because in each district the materials would differ. In one district you would probably limit

it to cement; in another, ordinary lime, chalk lime; in another—as we are situated in Leicester—chiefly we should have the hydraulic lime; and so on. Mr. Lemon indicated that all streets should be laid out before any buildings are erected—I suppose in most districts that this is so. But there are undoubtedly cases where a landowner has no present intention of laying out his land for building ground, and yet he will erect a house upon it which may seriously interfere with some future good line of communication. These are probably isolated cases; but there is no doubt it would be a great advantage if you could compel any landowner who intends to build an isolated house upon land that he may possess in contiguity to a town, to fix upon a plan of streets as regards that particular building. The town councils on the Continent have the power to lay out the whole of the ground round about the suburbs of a town so far as they may consider or think within the next fifty years the town may be likely to extend. They set to work by appointing a committee composed not merely of the town surveyor and a member or two of the council, but they call in the president for the time being of the architectural and engineering society of the town, and other architects also of local repute. The committee then hold sittings, and devise and lay out the whole of the ground; and the plan settled upon is laid open for six months. The owners of land affected are invited to examine the plan and to express their opinions upon it. In that way they arrive at a decision long before the necessity arises of extending particular streets. Objections must be taken within a certain time; if they are not taken within that time then the owners are assumed to have given their consent, and the plan cannot be altered without the consent of the authorities. In that way you have generally, in continental towns, well-planned streets. I do not mean to say that that would meet our circumstances, but I believe much could be done in that way. I remember that while holding the office which my friend on my right now holds in Carlisle, I made an attempt to deal with a particular district, and I succeeded to a very great extent in obtaining the consent of the owners to the streets I projected. I do not know whether any other Members of the Association have attempted anything of the kind or not; but I believe if we attempted more of it we should do much good; and if we could have support in that direction by a new Public Health Act, it would be a great advantage. There are many other points which might be touched upon, but at this

late hour it would be unwise to attempt to deal with them, and I should like to suggest again that this matter be referred to the Council, with the object I have stated.

The lateness of the hour now necessitated the closing of the discussion, and the importance of the subject under consideration rendering it advisable that the matter should receive the close attention of all the Members of this Association, the Council consider that they are giving expression to the feeling of the meeting in suggesting that at the next district meeting the subject should be again raised and again discussed, and that those who are unable to attend should send in their criticisms to the district secretaries.

A vote of thanks was cordially and unanimously passed to Mr. Jerram for his paper.

Votes of thanks were also passed to the President and Council of the Institution of Civil Engineers for the use of the Lecture Theatre; and to the President (Mr. Jones), for the able way in which he conducted the business of the meetings.

ANNUAL MEETING IN LONDON,

June 29, 30, and July 1, 1882.

BRADFORD TRAMWAYS.

By J. H. COX, BOROUGH SURVEYOR, BRADFORD.

The Bradford Corporation obtained powers in 1880 to construct $7\frac{1}{2}$ miles of tramways within the Borough of Bradford. Previous to commencing operations, tenders were invited for leasing and working the lines when complete; and ultimately they were leased to Messrs. Turton, Mason, and Busby, of Leeds and Liverpool, for 21 years, at an annual rental of 290*l.* for the first 10 years, and 300*l.* a year for the remainder of the term.

A hilly town like Bradford is not favourable for tramways, especially when worked by horse power; and it was therefore decided upon at the outset to construct the lines in a sufficiently substantial manner so as to admit of the use of steam power. The system of tramway adopted is known as Winby and Levick's, and consists of a girder-shaped steel rail 6 inches deep, mounted on and secured to a $\frac{3}{8}$ -inch wrought-iron base plate.

The gauge is 4 feet. The providing and laying of the rails have been let by contract to Messrs. Ridley and Co., of Newcastle, at 1998*l.* per mile of single line; but the paving works have been executed by Corporation workmen, and have cost 2500*l.* per mile of single line.

The Leeds Road section of the Bradford Tramways is a mile and 6 furlongs in length, with an almost continuous gradient of 1 in 21. It is proposed to work this section by steam power, and engines are now being built for the purpose by Messrs. Kitson and Co., of Leeds.

The Corporation are very desirous of extending the tramway system in Bradford, and it is intended to apply for powers in November next to construct an additional 7 miles of tramways;

but, unfortunately, the gradients on the routes selected are very severe, being in several cases 1 in 13, and as there is little hope of working them satisfactorily with horse power, the author was instructed to obtain information from other towns as to whether tramways had been constructed on similar gradients, and also whether steam power had been employed thereon. The questions set out in the accompanying Tabulated Statement were addressed to the Borough Engineers of the several places named on the list, who very courteously and promptly furnished the information asked for. Although the information contained in the statement may not be considered of general interest, yet it is to be hoped that it may prove of some little value to such towns as are contemplating the use of steam power on tramways.

On the evening of the first day the Members dined together at the Criterion Restaurant, Piccadilly.

On the evening of the second day the Members visited the Head-quarters of the Metropolitan Fire Brigade, Southwark Bridge Road, and were there shown the various matters of interest connected with this admirably conducted service by Mr. Symonds in the absence of Captain Shaw.

On the third day the Members visited the Pottery Works of Messrs. Doulton and Co., Lambeth, where they were most courteously received and conducted over the works by the Messrs. Doulton, who thoroughly explained the highly interesting details connected with the artistic branches of their business, and the principal features of the sanitary appliances exhibited by them. The Members were afterwards hospitably entertained at lunch by the firm.

Members also inspected the ventilating arrangements of the House of Lords. A visit was projected to see the more elaborate and interesting ventilating apparatus connected with the House of Commons, but owing to the prolongation of an "all-night sitting" of the House, the inspection was limited to the House of Lords, after which the party was admitted to see the works of the great clock.

At 2 o'clock p.m. the Members assembled at the new Law Courts, and were conducted over these extensive buildings by Mr. Moore, the Clerk of the Works, who pointed out and ably explained the many interesting features connected therewith.

NAME OF TOWN.	1 Have you Tram- ways in your Town?	2 Do they belong to the Corporation or to a Com- pany?	3 Whose system of has been adopted?
ABERDEEN ..	Yes	To a Company ..	They are ordinary on cross sleeper. concrete foundati
ASHTON-UNDER- LYNE.	Yes	Manchester Carriage and Tramways Com- pany.	Barker's system
BATLEY	Yes	A Company	Cross sleepers with foundation, and well's patent rail
BELFAST ..	Yes	To a Company, but the Corporation have (by Act of Parliament) the right to purchase 21 years after passing of Act, at the then structural value, not as a going concern.	The original system and longitudinal with spikes; c sett paving, &c. eight years in u Larsen pattern ra
BIRKENHEAD .	Yes	They are the pro- perty of two Com- panies.	The first lines we down in 1862, on in general use in A they were relaid i and again in 1878 grooved rails rest pine sleepers, an fastened at the si supported by sleepers laid on a c foundation. The between the rail for a width of 18 each side, is pave square setts.
BIRMINGHAM ..	Yes. About 4½ miles were laid 8 years ago, and ¾ of a mile is now being laid, and several miles sanc- tioned or now before the House.	They belong to the Corporation.	Larsen's patent used miles, at 4 ft. gauge. Barker's is laid for ¾ of a m 3 ft. 6 in. gaug will probably be u others.

NAME OF TOWN.	1 Have you Tram- ways in your Town?	2 Do they belong to the Corporation or to a Com- pany?	3 Whose system of Trams has been adopted?	4 Do they belong to the Corporation or to a Com- pany?
DUBLIN	About 16 miles	To the Dublin Tram- way Company.	They were laid on a the same as first used London and elsewhere. Longitudinal sleeper timber with tie across and very concrete, a plan imperfect, but they almost all laid in and 1872, when we no experience.	Corporation Company Company Company Company
DUNDEE	Yes	Constructed by and belonging to the Dundee Police Commissioners, but are leased to a Company for 21 years.	Three systems have adopted, viz.: 1st, W system; 2nd, G system; and 3rd, M son's system.	the C and le Compa vate C
EDINBURGH ..	Yes; about 12 miles.	To a private Com- pany.	Solid steel beam rails granite setts.	provincia Compa system ways course tion be Corpor privat as als line in rporat
GLASGOW ..	Yes	Belong to the Cor- poration, and are leased to a Com- pany.	Johnstone & Rankine's rails, dog spike, verse sleeper.	
GLOUCESTER ..	Yes	To a Company. ..	Kincaid's	
GREENOCK ..	Yes; since 1873	To the Corporation, but leased to a Company.	Larsen's patent..	
HULL	Yes	To a Company ..	Kincaid's	e Cor the ow nes, b way Cc a lease 21 y 1873.
LEEDS	Yes	To a Company ..	1st, continuous sleepers; 2nd, Kin system; 3rd, B system of continuo sleepers.	a Con e port to C and lea pany; other longst Comp
LEICESTER ..	Yes	They belong to a Company, and were constructed by them.	Kincaid's	

Memoirs of Deceased Members.

The Council, having been requested to append some short notice of the decease of Members of the Association, will feel obliged by early notice being forwarded to the Secretary, with such particulars as it may be desirable to insert in these 'Proceedings.'

It is with much regret that the Council have to chronicle the deaths of the following gentlemen, Members of this Association:—

Mr. George Cole, late City Surveyor, Hereford, died on the 1st October, 1881, resulting from an attack of bronchitis in its severest form, and from which he had been suffering for some few weeks.

The following extract, taken from the *Hereford Journal* of Oct. 8th, 1881, gives a short account of Mr. Cole's professional career:—

"Mr. Cole was appointed to the office of City Surveyor in the year 1859. Any one has only to consider the vast improvements which have taken place in Hereford from that time to the present, to come to the conclusion that the duties of his office have much increased from what they were when he commenced. In all directions the city has extended, and consequently where these extensions took place there was a necessity for an extension also of the water supply and of sewage works. Probably the first work of any importance with which the late Mr. Cole was connected, was the erection of the slaughter-houses and the Corporate buildings adjoining thereto in Commercial Road, which took place some few years after he assumed the office. Then came in subsequent years the extension of the water service in various directions to meet the growing needs of the city, and the extension of the sewage works to the Whitecross, St. Owen's, and Widemarsh districts. All of these works were under the supervision of Mr. Cole and were most ably carried out, and we believe that during the whole of his connection with the city the ratepayers never had

a more hard-working and able officer. His last important work, and the one perhaps by which he will be the longest remembered, was the scheme which he matured for the supply of water to Aylestone Hill, Hampton Park, and other high-lying districts of the city, by means of a water tower. This scheme was submitted to the Town Council, and, after being well considered, was adopted, and is now, as our readers know, in progress of being carried out. When one looks at the difficulties which had to be surmounted, the maturing of such a scheme must be of itself evidence of the high abilities which Mr. Cole displayed; and it must be a matter of regret to all that he did not live to see the completion of his plan, and to witness the benefits which it is expected to convey to these districts. Of late years the duties of his office have been multifarious, but notwithstanding that he was most energetic in the discharge of them, and only last winter we had a specimen of his energy in the rapid manner in which he opened up the street communications after the heavy fall of snow. That his death is a loss to the city there can be no doubt; even those who did not always hold with his views will admit this, and great sympathy is felt with his widow and children. The deceased gentleman was sixty-nine years of age."

Mr. Henry Alty, Borough Surveyor, Plymouth, died on the 15th March, 1882. Mr. Alty was appointed Surveyor to the Local Board, Keighley, Yorkshire, which post he held from 1873 to 1874. He was then appointed Borough Surveyor, Barrow-in-Furness, which he left in 1879 for Plymouth, where several works of considerable importance were carried out under his able superintendence, and where he won the respect and esteem of all who knew him. Mr. Alty was a Member of Council, and died at the early age of thirty-eight years.

PROCEEDINGS
OF
THE ASSOCIATION OF MUNICIPAL AND SANITARY
ENGINEERS AND SURVEYORS.

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SANITARY SUPERVISION OF DWELLINGS.—L. ANGELL.

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